

Sequences of HPV-16 Variants

Introduction

The following two alignments present sequence information for all available variants of HPV16.

In both alignments, agreement to the prototypic HPV16R sequence is indicated by a dash ('-'), while gaps, representing insertion-deletion events, are indicated by dots ('.'). At positions where a variant disagrees with the prototypic sequence, the variant nucleotides are shown in upper case if the nucleotide change causes a change in the protein sequence, or in lower case if the nucleotide change is "silent." In non-coding regions, all changes are displayed in upper case.

The alignment "HPV16 variation," beginning on page I-A9-62 concentrates specifically on the variability of each site. Each section of the HPV16R genome displayed defines a window which is used to determine the uniqueness of variant sequences, i.e., if several distinct variants are identical over one of these windows, the shared sub-sequence is reported only once. Note that the lines of sequence variation in different windows bear no definite relationship to one another; there is probably no variant that displays all of the changes that are found in the all of the first lines of the windows of sequence variation. In this alignment, a translation is supplied for each line of sequence variation with "non-silent" changes.

In the alignment starting on page I-A9-74 entitled "HPV16 variants," each variant possessing a unique sequence is displayed in its entirety. In the interest of saving space, when the sequences of several distinct isolates were identical, only one of these sequences was included in the alignment. In addition, amino acid sequences are explicitly reported for variants only when they differ both from the translation of the prototypic sequence and from the last-reported amino acid sequence for that section of the HPV16 genome. Thus, to locate the amino acid corresponding to a variant sequence, it will often be necessary to scan up the page to the last reported amino acid sequence. We believe that this style of presentation will increase the value of the alignment, by making it more compact but not detracting from the intelligibility of the information.

HPV16 variation
LCR, E6

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                                E6 orf start ->
                                signal      E2 binding      E2 binding      signal
                                ->  <-      ->  <-      ->  <-      ->  <-
HPV16R      ACTACAATAATTCATGTATAAACTAAGGGCGTAACCGAAATCGGTTGAACCGAAACCGGTTAGTATAAAAGC      73
HPV16R
                                -----
                                -----T-----
                                -----C-----

                                |-> mRNA start site from P97 promoter
                                degenerate E2 binding
first "ATG" of E6 orf ->      E6 cds ->      ->      <-
HPV16R      AGACATTTTATGCACCAAAGAGAACTGCAATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCACAG      145
HPV16R      ArgHisPheMetHisGlnLysArgThrAlaMetPheGlnAspProGlnGluArgProArgLysLeuProGln
                                -----
                                -----G-----
                                -----Gly-----
                                -----c-----
                                -----T-----
                                -----His-----
                                -----G-T-----
                                -----Gly-----
                                -----Asp-----
                                -----G-T-----
                                -----Asp-----
                                -----C-----
                                -----G-T-----
                                -----Thr-----
                                -----Asp-----
                                -----c-----
                                -----T-----
                                -----G-T-----
                                -----Ile-----
                                -----Asp-----

HPV16R      TTATGCACAGAGCTGCAAACAACTATACATGATATAATATTAGAATGTGTGTACTGCAAGCAACAGTTACTG      217
HPV16R      LeuCysThrGluLeuGlnThrThrIleHisAspIleIleLeuGluCysValTyrCysLysGlnGlnLeuLeu
                                -----
                                -----G-----
                                -----Val-----
                                -----G-----
                                -----Glu-----
                                -----G-----
                                -----Arg-----
                                -----T-----
                                -----Tyr-----

                                5' sj \ (E6*transcripts)
HPV16R      CGACGTGAGGTATATGACTTTTGCTTTTCGGGATTTATGCATAGTATATAGAGATGGGAATCCATATGCTGTGTA      289
HPV16R      ArgArgGluValTyrAspPheAlaPheArgAspLeuCysIleValTyrArgAspGlyAsnProTyrAlaVal
                                -----
                                -----A-A-----
                                -----LysAsn-----
                                -----t-----
                                -----a-g-----

HPV16R      TGTGATAAATGTTTAAAGTTTATTCTAAAATTAGTGAGTATAGACATTATGTTATAGTTTGTATGGAACA      361
HPV16R      CysAspLysCysLeuLysPheTyrSerLysIleSerGluTyrArgHisTyrCysTyrSerLeuTyrGlyThr
                                -----
                                -----G-----
                                -----Val-----
                                -----T-----
                                -----G-----
                                -----Tyr-----
                                -----Val-----
                                -----G-----
                                -----G-----
                                -----Tyr-----
                                -----Val-----
                                -----T-----
                                -----Tyr-----

                                \ / 3' sj (E6*I)
HPV16R      ACATTAGAACAGCAATACAACAAACCGTTGTGTGATTTGTTAATTAGGTGTATTAAGTGTCAAAGCCACTG      433
HPV16R      ThrLeuGluGlnGlnTyrAsnLysProLeuCysAspLeuLeuIleArgCysIleAsnCysGlnLysProLeu
                                -----
                                -----g-----

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**HPV16 variation
E6, E7, E1**

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HPV16R      TGTCTGAAGAAAAGCAAAGACATCTGGACAAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACCGGT      505
HPV16R      CysProGluGluLysGlnArgHisLeuAspLysLysGlnArgPheHisAsnIleArgGlyArgTrpThrGly
-----C-----
              Asp

              E7 orf start ->
              \| 3' sj (E6*II)                                <- E6 end
HPV16R      CGATGTATGTCTTGTTCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATC      561
HPV16R      $$$ArgAsnProAlaValIle
HPV16R      ArgCysMetSerCysCysArgSerSerArgThrArgArgGluThrGlnLeu$$$
-----g-----
-----G-----g-----
              Cys

E7 cds ->
HPV16R      ATGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTGCAACCAGAGACAACCTGATCTCTACTGT      633
HPV16R      MetHisGlyAspThrProThrLeuHisGluTyrMetLeuAspLeuGlnProGluThrThrAspLeuTyrCys
-----T-----
              Ser
-----A-----
              Lys

HPV16R      TATGAGCAATTAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTCCAGCTGGACAAGCAGAACCGGAC      705
HPV16R      TyrGluGlnLeuAsnAspSerSerGluGluGluAspGluIleAspGlyProAlaGlyGlnAlaGluProAsp
-----a-----
-----C-----
              Phe
-----T-----
              Leu
-----G-----
              Ser
-----a-----

HPV16R      AGAGCCCATTACAATATTGTAACCTTTTGTGTGCAAGTGTGACTCTACGCTTCGGTTGTGCGTACAAAGCACA      777
HPV16R      ArgAlaHisTyrAsnIleValThrPheCysCysLysCysAspSerThrLeuArgLeuCysValGlnSerThr
-----c-----

HPV16R      CACGTAGACATTTCGTACTTTGGAAGACCTGTTAATGGGCACACTAGGAATTGTGTGCCCATCTGTTCTCAG      849
HPV16R      HisValAspIleArgThrLeuGluAspLeuLeuMetGlyThrLeuGlyIleValCysProIleCysSerGln
-----c-----c-----
-----T-----
              Cys
-----c-----c-----
-----c-----g-----

E1 orf start ->      -> E1 cds
              <- E7 end      5' sj \|
HPV16R      AAACCATAATCTACCATGGCTGATCCTGCAGGTACCAATGGGGAAGAGGGTACGGGATGTAATGGATGGTTT      921
HPV16R      LysPro$$$SerThrMetAlaAspProAlaGlyThrAsnGlyGluGluGlyThrGlyCysAsnGlyTrpPhe
-----

HPV16R      TATGTAGAGGCTGTAGTGGAAAAAAGACAGGGGATGCTATATCAGATGACGAGAACGAAAATGACAGTGTAT      993
HPV16R      TyrValGluAlaValValGluLysLysThrGlyAspAlaIleSerAspAspGluAsnGluAsnAspSerAsp

HPV16R      ACAGGTGAAGATTGGTAGATTTTATAGTAAATGATAATGATTATTTAACACAGGCAGAAACAGAGACAGCA      1065
HPV16R      ThrGlyGluAspLeuValAspPheIleValAsnAspAsnAspTyrLeuThrGlnAlaGluThrGluThrAla

HPV16R      CATGCGTTGTTTACTGCACAGGAAGCAAACAACATAGAGATGCAGTACAGGTTCTAAAACGAAAGTATTTG      1137
HPV16R      HisAlaLeuPheThrAlaGlnGluAlaLysGlnHisArgAspAlaValGlnValLeuLysArgLysTyrLeu

              V additional 'G' in wild-type absent from original clone
HPV16R      GGTAGTCCACTTAGTGATATTAGTGGATGTGTAGACAATAATATTAGTCCTAGATTAAAAGCTATATGTATA      1209
HPV16R      GlySerProLeuSerAspIleSerGlyCysValAspAsnAsnIleSerProArgLeuLysAlaIleCysIle

HPV16R      GAAAAACAAAGTAGAGCTGCAAAAAGGAGATTATTTGAAAGCGAAGACAGCGGGTATGGCAATACTGAAGTG      1281
HPV16R      GluLysGlnSerArgAlaAlaLysArgArgLeuPheGluSerGluAspSerGlyTyrGlyAsnThrGluVal

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HPV16 variation
E1, E2

5' sj \\
HPV16R GAAACTCAGCAGATGTTACAGGTAGAAGGGCGCCATGAGACTGAAACACCATGTAGTCAGTATAGTGGTGGGA 1353
HPV16R GluThrGlnGlnMetLeuGlnValGluGlyArgHisGluThrGluThrProCysSerGlnTyrSerGlyGly
HPV16R AGTGGGGGTGGTTGCAGTCAGTACAGTAGTGAAGTGGGGGAGAGGGTGTAGTGAAGACACACTATATGC 1425
HPV16R SerGlyGlyGlyCysSerGlnTyrSerSerGlySerGlyGlyGluGlyValSerGluArgHisThrIleCys
HPV16R CAAACACCCTTACAAATATTTTAAATGTACTAAAACTAGTAATGCAAAGGCAGCAATGTTAGCAAAATTT 1497
HPV16R GlnThrProLeuThrAsnIleLeuAsnValLeuLysThrSerAsnAlaLysAlaAlaMetLeuAlaLysPhe
HPV16R AAAGAGTTATACGGGGTGAGTTTTCAGAATTAGTAAGACCATTTAAAAGTAATAAATCAACGTGTTGCGAT 1569
HPV16R LysGluLeuTyrGlyValSerPheSerGluLeuValArgProPheLysSerAsnLysSerThrCysCysAsp
HPV16R TGGTGTATTGCTGCATTTGGACTTACACCCAGTATAGCTGACAGTATAAAAACACTATTACAACATATTGT 1641
HPV16R TrpCysIleAlaAlaPheGlyLeuThrProSerIleAlaAspSerIleLysThrLeuLeuGlnGlnTyrCys
HPV16R TTATATTTACACATTCAAAGTTTAGCATGTTTCATGGGGAATGGTTGTGTACTATTAGTAAGATATAAATGT 1713
HPV16R LeuTyrLeuHisIleGlnSerLeuAlaCysSerTrpGlyMetValValLeuLeuLeuValArgTyrLysCys
HPV16R GGAAAAATAGAGAAACAATTGAAAAATTGCTGTCTAAACTATTATGTGTGTCTCCAATGTGTATGATGATA 1785
HPV16R GlyLysAsnArgGluThrIleGluLysLeuLeuSerLysLeuLeuCysValSerProMetCysMetMetIle
HPV16R GAGCCTCCAAAATTGCGTAGTACAGCAGCAGCATTATATTGGTATAAAAACAGGTATATCAAAATATTAGTGAA 1857
HPV16R GluProProLysLeuArgSerThrAlaAlaAlaLeuTyrTrpTyrLysThrGlyIleSerAsnIleSerGlu
HPV16R GTGTATGGAGACACGCCAGAATGGATACAAAGACAAACAGTATTACAACATAGTTTAAATGATTGTACATTT 1929
HPV16R ValTyrGlyAspThrProGluTrpIleGlnArgGlnThrValLeuGlnHisSerPheAsnAspCysThrPhe
HPV16R GAATTATCACAGATGTACAATGGGCTACGATAATGACATAGTAGACGATAGTAAAATGCATATAAAATAT 2001
HPV16R GluLeuSerGlnMetValGlnTrpAlaTyrAspAsnAspIleValAspAspSerGluIleAlaTyrLysTyr
HPV16R GCACAATTGGCAGACACTAATAGTAATGCAAGTGCCTTTCTAAAAAGTAATTCACAGGCAAAAATTGTAAAG 2073
HPV16R AlaGlnLeuAlaAspThrAsnSerAsnAlaSerAlaPheLeuLysSerAsnSerGlnAlaLysIleValLys
HPV16R GATTGTGCAACAATGTGTAGACATTATAACGAGCAGAAAAAAACAATGAGTATGAGTCAATGGATAAAA 2145
HPV16R AspCysAlaThrMetCysArgHisTyrLysArgAlaGluLysLysGlnMetSerMetSerGlnTrpIleLys
HPV16R TATAGATGTGATAGGGTAGATGATGGAGGTGATGGAAGCAAATGTTATGTTTTTAAGGTATCAAGGTGTA 2217
HPV16R TyrArgCysAspArgValAspAspGlyGlyAspTrpLysGlnIleValMetPheLeuArgTyrGlnGlyVal
HPV16R GAGTTTATGTCATTTTTAACTGCATTAAAAAGATTTTTGCAAGGCATACCTAAAAAAAATTGCATATTACTA 2289
HPV16R GluPheMetSerPheLeuThrAlaLeuLysArgPheLeuGlnGlyIleProLysLysAsnCysIleLeuLeu
HPV16R TATGGTGCAGCTAACACAGGTAAATCATTATTTGGTATGAGTTTAAATGAAATTTCTGCAAGGGTCTGTAATA 2361
HPV16R TyrGlyAlaAlaAsnThrGlyLysSerLeuPheGlyMetSerLeuMetLysPheLeuGlnGlySerValIle
HPV16R TGTTTTGTAAATCTAAAAGCCATTTTGGTTACAACCATTAGCAGATGCCAAAATAGGTATGTTAGATGAT 2433
HPV16R CysPheValAsnSerLysSerHisPheTrpLeuGlnProLeuAlaAspAlaLysIleGlyMetLeuAspAsp
HPV16R GCTACAGTGCCTGTGGAACTACATAGATGACAATTTAAGAAATGCATTGGATGGAAATTTAGTTTCTATG 2505
HPV16R AlaThrValProCysTrpAsnTyrIleAspAspAsnLeuArgAsnAlaLeuAspGlyAsnLeuValSerMet
HPV16R GATGTAAGCATAGACCATTGGTACAACATAAAATGCCCTCCATTATTAATTACATCTAACATTAATGCTGGT 2577
HPV16R AspValLysHisArgProLeuValGlnLeuLysCysProProLeuLeuIleThrSerAsnIleAsnAlaGly
\\ / 3' sj
HPV16R ACAGATTCTAGGTGGCCTTATTTACATAATAGATTGGTGGTGTTTACATTTCTAATGAGTTTCCATTTGAC 2649
HPV16R ThrAspSerArgTrpProTyrLeuHisAsnArgLeuValValPheThrPheProAsnGluPheProPheAsp
\\ / 3' sj (E2, E5)
HPV16R GAAAACGGAAATCCAGTGTATGAGCTTAATGATAAGAAGTGGAAATCCTTTTTCTCAAGGACGTGGTCCAGA 2721
HPV16R GluAsnGlyAsnProValTyrGluLeuAsnAspLysAsnTrpLysSerPhePheSerArgThrTrpSerArg
E2 orf start -> E2 cds ->
HPV16R TTAAGTTTGCACGAGGACGAGGACAAGGAAAACGATGGAGACTCTTTGCCAACGTTTAAATGTGTGTCAGGAC 2794
HPV16R LeuSerLeuHisGluAspGluAspLysGluAsnAspGlyAspSerLeuProThrPheLysCysValSerGlyG
HPV16R \$\$\$ValCysThrArgThrArgThrArgLysThrMetGluThrLeuCysGlnArgLeuAsnValCysGlnAsp
<- E1 end
HPV16R AAAATACTAACACATTATGAAAATGATAGTACAGACCTACGTGACCATATAGACTATTGGAAACACATGCGC 2866
HPV16R InAsnThrAsnThrLeu\$\$\$
HPV16R LysIleLeuThrHisTyrGluAsnAspSerThrAspLeuArgAspHisIleAspTyrTrpLysHisMetArg
HPV16R CTAGAATGTGCTATTTTATTACAAGGCCAGAGAAATGGGATTTAAACATATTAACCACCAAGTGGTGCCAACA 2938
HPV16R LeuGluCysAlaIleTyrTyrLysAlaArgGluMetGlyPheLysHisIleAsnHisGlnValValProThr
HPV16R CTGGCTGTATCAAAGAATAAAGCATTACAAGCAATTGAACTGCAACTAACGTTAGAAACAATATATAACTCA 3010
HPV16R LeuAlaValSerLysAsnLysAlaLeuGlnAlaIleGluLeuGlnLeuThrLeuGluThrIleTyrAsnSer

**HPV16 variation
E2, E4, E5**

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HPV16R      CAATATAGTAATGAAAAGTGGACATTACAAGACGTTAGCCTTGAAGTGTATTTAACTGCACCAACAGGATGT 3082
HPV16R      GlnTyrSerAsnGluLysTrpThrLeuGlnAspValSerLeuGluValTyrLeuThrAlaProThrGlyCys

HPV16R      AATAAAAAACATGGATATACAGTGGAAAGTGCAGTTTGTATGGAGACATATGCAATACAATGCATTATACAAAC 3154
HPV16R      IleLysLysHisGlyTyrThrValGluValGlnPheAspGlyAspIleCysAsnThrMetHisTyrThrAsn

HPV16R      TGGACACATATATATATTTGTGAAGAAGCATCAGTAACTGTGGTAGAGGGTCAAGTTGACTATTATGGTTTA 3226
HPV16R      TrpThrHisIleTyrIleCysGluGluAlaSerValThrValValGluGlyGlnValAspTyrTyrGlyLeu

HPV16R      TATTATGTTTCATGAAGGAATACGAACATATTTTGTGCAGTTTAAAGATGATGCAGAAAAATATAGTAAAAAT 3298
HPV16R      TyrTyrValHisGluGlyIleArgThrTyrPheValGlnPheLysAspAspAlaGluLysTyrSerLysAsn

                                E4 orf start ->(NH2 terminus unknown)\ / 3' sj
HPV16R      AAAGTATGGGAAGTTCATGCGGGTGGTGCAGGTAATATTATGTCCTACATCTGTGTTTAGCAGCAACGAAGTA 3370
HPV16R      LysValTrpGluValHisAlaGlyGlyGlnValIleLeuCysProThrSerValPheSerSerAsnGluVal
HPV16R      $$$TyrTyrValLeuHisLeuCysLeuAlaAlaThrLysTy

HPV16R      TCCTCTCTGAAATTATTAGGCAGCACTTGGCCAACCACCCCGCCGCGACCCATACCAAAGCCGTCGCCTTG 3442
HPV16R      SerSerProGluIleIleArgGlnHisLeuAlaAsnHisProAlaAlaThrHisThrLysAlaValAlaLeu
HPV16R      rProLeuLeuLysLeuLeuGlySerThrTrpProThrThrProProArgProIleProLysProSerProTr

HPV16R      GGCACCGAAGAAACACAGACGACTATCCAGCGACCAAGATCAGAGCCAGACACCGAAAACCCCTGCCACACC 3514
HPV16R      GlyThrGluGluThrGlnThrThrIleGlnArgProArgSerGluProAspThrGlyAsnProCysHisThr
HPV16R      pAlaProLysLysHisArgArgLeuSerSerAspGlnAspGlnSerGlnThrProGluThrProAlaThrPr

HPV16R      ACTAAGTTGTTGCACAGAGACTCAGTGGACAGTGCCTCCAATCCTCACTGCATTTAACAGCTCACACAAAGGA 3586
HPV16R      ThrLysLeuLeuHisArgAspSerValAspSerAlaProIleLeuThrAlaPheAsnSerSerHisLysGly
HPV16R      oLeuSerCysCysThrGluThrGlnTrpThrValLeuGlnSerSerLeuHisLeuThrAlaHisThrLysAs

                                5' sj \ /
                                <- E4 end
HPV16R      CGGATTAAGTAACTGTAATAGTAACACTACACCCATAGTACATTTAAAAGGTGATGCTAATACTTTAAAAATGTTTA 3658
HPV16R      ArgIleAsnCysAsnSerAsnThrThrProIleValHisLeuLysGlyAspAlaAsnThrLeuLysCysLeu
HPV16R      pGlyLeuThrValIleValThrLeuHisPro$$$

HPV16R      AGATATAGATTTAAAAGCATTGTACATTGTATACTGCAGTGTCTGCTACATGGCATTGGACAGGACATAAT 3730
HPV16R      ArgTyrArgPheLysLysHisCysThrLeuTyrThrAlaValSerSerThrTrpHisTrpThrGlyHisAsn

HPV16R      GTAAAACATAAAAAGTGAATTTGTTACTTACATATGATAGTGAATGGCAACGTGACCAATTTTTGTCTCAA 3802
HPV16R      ValLysHisLysSerAlaIleValThrLeuThrTyrAspSerGluTrpGlnArgAspGlnPheLeuSerGln

                                <- E2 end
E5 orf start ->                                E5 cds ->
HPV16R      GTTAAAAATACCAAAAACATTTACAGTGTCTACTGGATTTATGTCTATATGACAAATCTTGATACTGCATCC 3873
HPV16R      $$$AsnThrLysAsnTyrTyrSerValTyrTrpIleTyrValTyrMetThrAsnLeuAspThrAlaSer
HPV16R      ValLysIleProLysThrIleThrValSerThrGlyPheMetSerIle$$$

                                -----
                                -----a-----
                                -----A-----
                                Tyr
                                -----c-----
                                -----c-----nA-----
                                Thr
                                -----c-----A-----
                                Thr
                                -----c-----cA-----
                                Thr

HPV16R      ACAACATTACTGGCGTGCTTTTGTCTTTGCTTTTGTGTGCTTTTGTGTGCTGCTTATTAATACGTCCGCTG 3945
HPV16R      ThrThrLeuLeuAlaCysPheLeuLeuCysPheCysValLeuLeuCysValCysLeuLeuIleArgProLeu
                                -----
                                G-----G-----
                                Ala-----Val-----
                                -----t-----
                                -----A-----
                                Ile

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HPV16 variation
E5, L2

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HPV16R      CTTTTGTCTGTGTCTACATACACATCATTAAATAATATTGGTATTACTATTGTGGATAACAGCAGCCTCTGCG 4017
HPV16R      LeuLeuSerValSerThrTyrThrSerLeuIleIleLeuValLeuLeuLeuTrpIleThrAlaAlaSerAla
-----C-----
Leu
-----C--c-----
Leu
-----C-----
Pro Leu
-----C-----G-----
Leu Val
-----C-----G-----a
Leu Val
-----C-----t-----
Leu
-----G-----c--t-----T-----
Val Val Phe

HPV16R      TTTAGGTGTTTTATTGTATATATTATATTTGTTTATATACCATTATTTTAAATACATACACATGCACGCTTT 4089
HPV16R      PheArgCysPheIleValTyrIleIlePheValTyrIleProLeuPheLeuIleHisThrHisAlaArgPhe
-----G-----
Val
-----G-----t-----
Val
-----C-----t-----
ThrVal
-----G--C-----t-----
ValSer
-----g-----G-----
Val
-----G-----n-----
Val
-----G-----c-----
Val
-----G-----c-----c
Val
-----T-----n-----
Leu
-----T-----g-----
Leu
-----T-----
Leu
-----T-----G
Leu Leu
-----T-----c-----
Leu

      <- E5 end          L2 orf start ->

HPV16R      TTAATTACATAATGTATATGTACATAATGTAATTGTTACATATAATGTGTATACCATAACTTACTATTTT 4161
HPV16R      LeuIleThr$$$CysIleCysThr$$$CysAsnCysTyrIle$$$LeuLeuTyrThrIleThrTyrTyrPhe
-----

      early poly-A signal -> <-
HPV16R      TTCTTTTTTATTTTCATATATAATTTTTTTTTTTGTTGTTTGTGTTTTAATAAACTGTTACTTACTTA 4233
HPV16R      PhePhePheIlePheIleTyrAsnPhePhePheCysLeuPheValCysPheLeuIleAsnCysTyrTyrLeu

L2 cds ->          signal -> <-
HPV16R      ACAATGCGACACAAACGTTCTGCAAAACGCACAAAACGTGCATCGGCTACCCAACCTTATAAAACATGCAAA 4305
HPV16R      ThrMetArgHisLysArgSerAlaLysArgThrLysArgAlaSerAlaThrGlnLeuTyrLysThrCysLys
-----
-----c-----

HPV16R      CAGGCAGGTACATGTCCACCTGACATTATACCTAAGGTTGAAGGCAAAACTATTGCTGATCAAATATTACAA 4377
HPV16R      GlnAlaGlyThrCysProProAspIleIleProLysValGluGlyLysThrIleAlaAspGlnIleLeuGln
-----g-----
-----a-----

```

**HPV16 variation
L2**

HPV16R HPV16R	TATGGAAGTATGGGTGTATTTTTGGTGGGTTAGGAATTGGAACAGGGTCGGGTACAGGCGGACGCACTGGG TyrGlySerMetGlyValPhePheGlyGlyLeuGlyIleGlyThrGlySerGlyThrGlyGlyArgThrGly ----- -----g----- -----c----- -----a----- -----t----- -----t-----	4449
HPV16R HPV16R	TATATTCCATTGGGAACAAGGCCTCCCACAGCTACAGATACACTTGCTCCTGTAAGACCCCTTTAACAGTA TyrIleProLeuGlyThrArgProProThrAlaThrAspThrLeuAlaProValArgProProLeuThrVal ----- -----a----- -----a----- -----a-----g----- -----g----- -----c-----a----- -----c-----a-----t-----	4521
HPV16R HPV16R	GATCCTGTGGGCCCTTCTGATCCTTCTATAGTTTCTTTAGTGAAGAACTAGTTTATTGATGCTGGTGCA AspProValGlyProSerAspProSerIleValSerLeuValGluGluThrSerPheIleAspAlaGlyAla ----- -----c----- -----g----- -----g-----g----- -----g-----	4593
HPV16R HPV16R	CCAACATCTGTACCTTCCATTCCCCAGATGTATCAGGATTTAGTATTACTACTTCAACTGATACCACACCT ProThrSerValProSerIleProProAspValSerGlyPheSerIleThrThrSerThrAspThrThrPro ----- -----c----- -----C-----a----- Pro -----C-----c-----a----- Pro -----cC-----a----- Pro	4665
HPV16R HPV16R	GCTATATTAGATATTAATAACTGTACTACTGTTACTACTACACATAATAATCCCACTTTCCTGACCCATCT AlaIleLeuAspIleAsnAsnThrValThrThrValThrThrHisAsnAsnProThrPheThrAspProSer ----- -----t-----	4737
HPV16R HPV16R	GTATTGCAGCCTCCAACACCTGCAGAACTGGAGGCATTTTACACTTTCATCATCCACTATTAGTACACAT ValLeuGlnProProThrProAlaGluThrGlyGlyHisPheThrLeuSerSerSerThrIleSerThrHis -----	4809
HPV16R HPV16R	AATTATGAAGAAATTCCTATGGATACATTTATTGTTAGCACAAACCTAACACAGTAACTAGTAGCACACC AsnTyrGluGluIleProMetAspThrPheIleValSerThrAsnProAsnThrValThrSerSerThrPro ----- -----a----- C----- His -----t-----	4881
HPV16R HPV16R	ATACCAGGGTCTCGCCAGTGGCAGCCTAGGATTATATAGTCGCACAACACAACAGGTTAAAGTTGTAGAC IleProGlySerArgProValAlaArgLeuGlyLeuTyrSerArgThrThrGlnGlnValLysValValAsp ----- -----a----- -----t-----a----- -----g-----a----- -----g-----a-----g----- -----g-----a-----g-----g-----	4953
HPV16R HPV16R	CCTGCTTTTGTAACTCCCACTAACTTATTACATATGATAATCCTGCATATGAAGGTATAGATGTGGAT ProAlaPheValThrThrProThrLysLeuIleThrTyrAspAsnProAlaTyrGluGlyIleAspValAsp ----- -----A----- Ile -----G----- Ala	5025

HPV16R AATACATTATATTTTTCTAGTAATGATAATAGTATTAATATAGCTCCAGATCCTGACTTTTTGGATATAGTT 5097
 HPV16R AsnThrLeuTyrPheSerSerAsnAspAsnSerIleAsnIleAlaProAspProAspPheLeuAspIleVal

 -----A-----
 Asn
 -----C--A-----
 ProAsn
 -----C-----
 Pro
 -----G--C-----
 Val Pro
 -----g-----
 -----T-----C-----t-----
 Phe Pro
 -----T-----C-----
 Phe Pro

HPV16R GCTTTACATAGGCCAGCATTAACTCTAGGCGTACTGGCATTAGGTACAGTAGAATTGGTAATAAACAAACA 5169
 HPV16R AlaLeuHisArgProAlaLeuThrSerArgArgThrGlyIleArgTyrSerArgIleGlyAsnLysGlnThr

 -----t-----
 -----a-----
 -----a-----
 -----a-----C-----
 Leu

HPV16R CTACGTACTCGTAGTGGAAAATCTATAGGTGCTAAGGTACATTATTATTATGATTTAAGTACTATTGATCCT 5241
 HPV16R LeuArgThrArgSerGlyLysSerIleGlyAlaLysValHisTyrTyrTyrAspLeuSerThrIleAspPro

 -----C-----
 Phe
 -----T-----
 Phe
 -----T-----c-----
 Phe
 -----g-----
 -----C-----A-----
 Phe Asn
 -----g-----A-----
 Asn
 -----A-----
 Asn
 -----G-----A-----
 Ser Asn

HPV16R GCAGAAGAAATAGAATTACAACTATAACACCTTCTACATATACTACCACTTCACATGCAGCCTCACCTACT 5313
 HPV16R AlaGluGluIleGluLeuGlnThrIleThrProSerThrTyrThrThrThrSerHisAlaAlaSerProThr

 -----C-----
 His
 -----G-----c-----
 Ala
 -----C-----G-----c-----
 Asp Ala
 -----g-----C-----c-----
 Pro
 -----a-----c-----
 -----a-----c-----a-----

HPV16R TCTATTAATAATGGATTATATGATATTTATGCAGATGACTTTATTACAGATACTTCTACAACCCCGGTACCA 5385
 HPV16R SerIleAsnAsnGlyLeuTyrAspIleTyrAlaAspAspPheIleThrAspThrSerThrThrProValPro

 -----T-----
 Phe
 -----c-----
 -----A-----
 Glu
 -----a-----
 -----T-----a-----
 Phe
 -----GT-----a-----
 Val

**HPV16 variation
L2, L1**

```

HPV16R      TCTGTACCCTCTACATCTTTATCAGGTTATATTCCTGCAAATACAACAATTCCTTTTGGTGGTGCATACAAT 5457
HPV16R      SerValProSerThrSerLeuSerGlyTyrIleProAlaAsnThrThrIleProPheGlyGlyAlaTyrAsn
-----
                                     -C-
                                       His
-T-----
Phe
---A-----c-----
      Ile
G--A-----c-----
AlaIle

                                     L1 orf start ->
HPV16R      ATTCTTTAGTATCAGGTCCTGATATACCCATTAATATAACTGACCAAGCTCCTTCATTAATTCCTATAGTT 5529
HPV16R      IleProLeuValSerGlyProAspIleProIleAsnIleThrAspGlnAlaProSerLeuIleProIleVal
                                     $$$Ph
-----
                                     -C-
                                       Leu
-----
                                     C-      A-
                                       Thr      Thr
-----t-----C-----A-----
                                       Thr      Thr
-----t-----CC-----A-----
                                       Thr      Thr
-----a-----t-----C-----A-----
                                       Thr      Thr
-----a-----t-----C-----A-----
                                       Thr  Asn  Thr

      first "ATG" of L1 orf ->
HPV16R      CCAGGGTCTCCACAATATACAATTATGCTGATGCAGGTGACTTTTATTTACATCCTAGTTATTACATGTTA 5601
HPV16R      ProGlySerProGlnTyrThrIleIleAlaAspAlaGlyAspPheTyrLeuHisProSerTyrTyrMetLeu
HPV16R      eGlnGlyLeuHisAsnIleGlnLeuLeuLeuMetGlnValThrPheIleTyrIleLeuValIleThrCysTy
-----
                                     -G-
                                       Gly
--g-----G-----
                                       Gly

                                     \ / 3' sj
                                     L1 cds ->                                     <- L2 end
HPV16R      CGAAAAACGACGTAAACGTTTACCATATTTTTTTTCAGATGTCTCTTTGGCTGCCTAGT 5659
HPV16R      ArgLysArgArgLysArgLeuProTyrPhePheSerAspValSerLeuAlaAla$$$
HPV16R      rGluAsnAspValAsnValTyrHisIlePhePheGlnMetSerLeuTrpLeuProSer
-----

HPV16R      GAGGCCACTGTCTACTTGCCTCCTGTCCCAGTATCTAAGGTGTGAAGCACGGATGAATATGTTGCACGCACA 5731
HPV16R      GluAlaThrValTyrLeuProProValProValSerLysValValSerThrAspGluTyrValAlaArgThr
-----
                                     a
-----

HPV16R      AACATATATTATCATGCAGGAACATCCAGACTACTTGCAGTTGGACATCCCTATTTTCCTATTAATAAAACCT 5803
HPV16R      AsnIleTyrTyrHisAlaGlyThrSerArgLeuLeuAlaValGlyHisProTyrPheProIleLysLysPro
-----

HPV16R      AACAAATAACAAAATATTAGTTCCTAAAGTATCAGGATTACAATACAGGGTATTTAGAATACATTTACCTGAC 5875
HPV16R      AsnAsnAsnLysIleLeuValProLysValSerGlyLeuGlnTyrArgValPheArgIleHisLeuProAsp
-----
                                     T-
                                       Tyr
-----

HPV16R      CCCAATAAGTTTGGTTTTCCTGACACCTCATTTTATAATCCAGATACACAGCGGCTGGTTTGGGCCCTGTGTA 5947
HPV16R      ProAsnLysPheGlyPheProAspThrSerPheTyrAsnProAspThrGlnArgLeuValTrpAlaCysVal
-----
-G-----
      Asp
-----c-----

HPV16R      GGTGTTGAGGTAGGTCGTGGTCAGCCATTAGGTGTGGGCATTAGTGGCCATCCTTTATTAATAAAATTGGAT 6019
HPV16R      GlyValGluValGlyArgGlyGlnProLeuGlyValGlyIleSerGlyHisProLeuLeuAsnLysLeuAsp
-----c-----

```

HPV16R 6091 GACACAGAAAATGCTAGTGCTTATGCAGCAAATGCAGGTGTGGATAATAGAGAATGTATATCTATGGATTAC
 HPV16R AspThrGluAsnAlaSerAlaTyrAlaAlaAsnAlaGlyValAspAsnArgGluCysIleSerMetAspTyr
 -----g-----

HPV16R 6163 AAACAAACACAATTGTGTTTAAATTGGTTGCAAACCACCTATAGGGGAACACTGGGGCAAAGGATCCCCATGT
 HPV16R LysGlnThrGlnLeuCysLeuIleGlyCysLysProProIleGlyGluHisTrpGlyLysGlySerProCys
 -----C-----
 Leu
 -----c-----

HPV16R 6235 degenerate E2 bind -> <-
 HPV16R ACCAATGTTCAGTAAATCCAGGTGATTGTCCACCATTAGAGTTAATAAACACAGTTATTCAGGATGGTGTAT
 HPV16R ThrAsnValAlaValAsnProGlyAspCysProProLeuGluLeuIleAsnThrValIleGlnAspGlyAsp
 -----C-----
 Thr
 -----A-----
 Ile
 -----C-----
 Leu
 -----c-----
 -A-----
 Asn
 -A-----C-----
 Asn Thr

HPV16R 6307 V wild-type has 'G', original clone had 'C'
 HPV16R ATGGTTGATACTGGCTTTGGTGCTATGGACTTTACTACATTACAGGCTAACAAAAGTGAAGTTCCTACTGGAT
 HPV16R MetValAspThrGlyPheGlyAlaMetAspPheThrThrLeuGlnAlaAsnLysSerGluValProLeuAsp
 -----G-----
 Gly
 -----c-----

HPV16R 6379 ATTTGTACATCTATTTGCAAATATCCAGATTATATTAATAATGGTGTGCAGAACCATATGGCGACAGCTTATTT
 HPV16R IleCysThrSerIleCysLysTyrProAspTyrIleLysMetValSerGluProTyrGlyAspSerLeuPhe
 -----g-----

HPV16R 6451 TTTTATTTACGAAGGGAACAAATGTTTGTAGACATTTATTTAATAGGGCTGGTACTGTTGGTGAAAATGTA
 HPV16R PheTyrLeuArgArgGluGlnMetPheValArgHisLeuPheAsnArgAlaGlyThrValGlyGluAsnVal
 -----G-----
 Ala
 -----g-----G-----
 Ala
 -----G-----C-----
 Ala His

HPV16R 6523 CCAGACGATTTATACATTAAGGCTCTGGGTCTACTGCAAATTTAGCCAGTTCAAATTATTTCTACACCT
 HPV16R ProAspAspLeuTyrIleLysGlySerGlySerThrAlaAsnLeuAlaSerSerAsnTyrPheProThrPro
 -----G-----
 Gly
 -----C-----
 Pro

HPV16R 6595 degenerate E2 bind -> <-
 HPV16R AGTGGTTCTATGGTTACCTCTGATGCCCAAATATTCAATAAACCTTATTGGTTACAACGAGCACAGGGCCAC
 HPV16R SerGlySerMetValThrSerAspAlaGlnIlePheAsnLysProTyrTrpLeuGlnArgAlaGlnGlyHis
 -----c-----
 -----t-----
 -----t-----
 -----t-----c-----
 -----t-----a-----
 -----t-----a-----g-----
 -----a-----t-----

**HPV16 variation
L1, LCR**

```

HPV16R      AATAATGGCATTGTGTTGGGGTAACCAACTATTTGTTACTGTGTTGATACTACACGCAGTACAAAATATGTCA 6667
HPV16R      AsnAsnGlyIleCysTrpGlyAsnGlnLeuPheValThrValValAspThrThrArgSerThrAsnMetSer
-----G-----
                      Ser

HPV16R      TTATGTGCTGCCATATCTACTTCAGAACTACATATAAAAAATACTAACTTTAAGGAGTACCTACGACATGGG 6739
HPV16R      LeuCysAlaAlaIleSerThrSerGluThrThrTyrLysAsnThrAsnPheLysGluTyrLeuArgHisGly
-----a-----
                      C-----a-----
                      Pro

HPV16R      GAGGAATATGATTTACAGTTTATTTTCAACTGTGCAAAATAACCTTAACTGCAGACGTTATGACATACATA 6811
HPV16R      GluGluTyrAspLeuGlnPheIlePheGlnLeuCysLysIleThrLeuThrAlaAspValMetThrTyrIle
-----T-----
                      Ser

HPV16R      CATTCTATGAATCCACTATTTTGGAGGACTGGAATTTTGGTCTACAACCTCCCCAGGAGGCACACTAGAA 6883
HPV16R      HisSerMetAsnSerThrIleLeuGluAspTrpAsnPheGlyLeuGlnProProProGlyGlyThrLeuGlu
-----c-----
                      t-----
-----t-----t-----
                      t-----t-----

HPV16R      GATACTTATAGGTTTGTAAACATCCCAGGCAATTGCTTGTCAAAAACATACACCTCCAGCACCTAAAGAAGAT 6955
HPV16R      AspThrTyrArgPheValThrSerGlnAlaIleAlaCysGlnLysHisThrProProAlaProLysGluAsp
-----T-----
                      Val

HPV16R      CCCCTTAAAAATACACTTTTTGGGAAGTAAATTTAAAGGAAAAGTTTTCTGCAGACCTAGATCAGTTTCCT 7027
HPV16R      ProLeuLysLysTyrThrPheTrpGluValAsnLeuLysGluLysPheSerAlaAspLeuAspGlnPhePro
-----C-----
                      Gln
-----C-----
                      Ser
-----t-----a-----
-----T-----t-----a-----
                      Asn
-----C-----t-----a-----
                      Thr
-----t-----a-----

HPV16R      TTAGGACGCAAATTTTACTACAAGCAGGATTGAAGGCCAAACCAAATTTACATTAGGAAAACGAAAAGCT 7099
HPV16R      LeuGlyArgLysPheLeuLeuGlnAlaGlyLeuLysAlaLysProLysPheThrLeuGlyLysArgLysAla
-----a-----
-----c-----
                      T-----
                      Phe
-----T-----g-----
                      Phe
-----g-----T-----
                      Phe

nuclear localization signal (NLS) ->          LCR ->
                                         <- <- L1 end
                                         |- putative inhibitory element
HPV16R      ACACCCACCACCTCATCTACCTCTACAACGCTAAACGCAAAAACGTAAGCTGTAAGTATTGTATGTATGT 7171
HPV16R      ThrProThrThrSerSerThrSerThrThrAlaLysArgLysLysArgLysLeu$$$
-----

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HPV16 variation
LCR

putative inhibitory element -|

HPV16R TGAATTAGTGTGTTTGTGTATATGTTTGTATGTGCTTGTATGTGCTTGATAAATATTAAGTTGTATGTG 7243

-----T-----C-----
-----T-----
-----T-----G-----
-----N-----NN-----
-----T-----C-----

HPV16R TGTTTGTATGTATGGTATAATAAACACGTGTGTATGTGTTTAAATGCTTGTGTAACCTATTGTGTCATGCA 7315

-----G-----

poly-A signal -> <-

HPV16R ACATAAATAAACTTATTGTTTCAACACCTACTAATTGTGTTGTGGTTATTCATTGTATATAAACTATATTTG 7387

-----C-----
-----T-----

E2 binding ->

HPV16R CTACATCCTGTTTTGTTTTATATATACTATATTTTGTAGCGCCAGCGCCATTTGTAGCTTCAACCGAAT 7459

-----C-----
-----TT-----

<- E2 binding

HPV16R TCGG.TTGCATGCTTTTTGGCACAAAATGTGTTTTTTAAATAGTTCTATGTCAGCAACTATGGTTTAAACT 7530

-----A-----
-----C-----A-----
-----T-----A--C-----
-----C-----A-----
TA-----
-----A-----A-----
-----C--A-----A-----
-----C--A-----G-----A-----
-----T-----C--A-----A-----
-----C--A-----C-----A-----

HPV16R TGTACGTTTCCTGCTTGCCATGCGTGCCAAATCCCTGTTTTCTGACCTGCACTGCTTGCCAACCATTCCAT 7602

-----A-----
-----T-----
-----A-----
-----G-----
-----C-----
-----T-----

signal -> <-

HPV16R TGTTTTTTTACACT.GCACTATGTG.CAACTACTGAATCACTATGTACATTGTGTCATATAAAAATAAATCACT 7672

-----A-----
-----G-----
-----G-----
-----G-----
-----T-----
-----G-----G-----T-----
-----G-----T-----T-----
-----G-----T-----
-----C-----G-----T-----

**HPV16 variation
LCR**

HPV16R ATGCGCCAACGCCTTACATACCGCTGTAGGCACATATTTTTGGCTTGTTTTAACTAACCTAATTGCATATTT 7745

.....
----- C-----

----- G-----
----- G-----
----- A-----
----- A----- A-----
----- A-----
----- A----- C-----
----- A----- T----- G-----
----- A----- C----- G-----
----- A----- T-----
----- A----- C----- G-----

HPV16R GGCATAAGGTTTAAACTTCTAAGGCCAACTAAATGTCACCCCTAGTTCATACATGAACTGTGTAAAGGTTAGTC 7818

.....
----- A-----
----- C----- C-----
----- C-----
----- T-----
----- T-----
----- G-----
----- G-----
----- C----- G-----
----- T-----
----- T-----
----- T----- T-----
----- T----- T-----
----- C----- T----- T-----
----- G----- T----- T-----

HPV16R ATACATTGTTTCATTTGTAAAACCTGCACATGGGTGTGTGCAAACCGTTTTGGGTTACACATTTACAAGCAACTT 7891

----- A-----
----- A-----
----- G-----
----- T-----
----- A----- T-----
----- A----- T----- T-----
----- A----- T----- T----- G-----
----- A----- T----- G-----
----- A----- T----- C----- G-----

HPV16R signal -> <-
ATATAATAATACTAA 7906

**HPV16 variants
LCR**

	signal	E2 binding	E6 orf start ->	E2 binding	signal	
	-> <-	-> <-	-> <-	-> <-	-> <-	
HPV16R	ACTACAATAATTCATGTATAAACTAAGGGCGTAACCGAAATCGGTTGAACCGAAACCGGTTAGTATAAAAGC					73
HPV16R					\$\$\$TyrLysSer	
HDS117A.04/09/92	-----					73
HDS117A.08/12/92	-----					73
HDS84C.03/26/90	-----					73
HDS84C.07/23/90	-----					73
HDS138.05/01/91	-----					73
HDS106C.05/08/90	-----					73
HDS106A.02/13/90	-----T-----					73
HDS84B.03/26/90	-----C-----					73
HDS84D.07/23/90	-----C-----					73
HDS106B.02/13/90	-----C-----					73

**HPV16 variants
LCR, E6**

```

                                |-> mRNA start site from P97 promoter
                                degenerate E2 binding
first "ATG" of E6 orf ->      E6 cds ->      ->      <-
HPV16R      AGACATTTTATGCACCAAAGAGAACTGCAATGTTTCAGGACCCACAGGAGCGACCCAGAAAGTTACCCACAG      145
HPV16R      ArgHisPheMetHisGlnLysArgThrAlaMetPheGlnAspProGlnGluArgProArgLysLeuProGln
HDS117A.04/09/92 ----- 104
HDS117A.08/12/92 ----- 104
HDS84C.03/26/90 ----- 104
HDS84C.07/23/90 ----- 104
HDS138.05/01/91 ----- 104
HDS106C.05/08/90 ----- 104
HDS106A.02/13/90 ----- 104
HDS84B.03/26/90 ----- 104
HDS84D.07/23/90 ----- 104
HDS106B.02/13/90 ----- 104
OR.5110 ----- 42
OR.4724 ----- 42
NM.T455 ----- 42
O204 ----- 42
O356 ----- 42
OR.4997 ----- 42
O489 ----- 42
                                G-----
                                Gly
OR.0198 ----- 42
OR.9237 ----- 42
NM.T197 ----- 42
NM.T446 ----- 42
O425 ----- 42
OR.6311 ----- 42
OR.8329 ----- 42
OR.6170 ----- 42
OR.4716 ----- 42
OR.7574 ----- 42
OR.2087 ----- 42
OR.5428 ----- 42
OR.8392 -----T 42
                                His
OR.1783 -----T 42
O462 -----T 42
O191 -----T 42
NM.4094 -----T 42
OR.4541 -----T 42
OR.4072 -----T 42
NM.9999 -----T 42
NM.T529 -----T 42
O512 -----T 42
OR.3136 -----T 42
O162 -----G-----G-T 42
                                Gly      Asp
O561 -----G-T 42
                                Asp
OR.1905 -----C-----G-T 42
                                Thr      Asp
OR.6106 -----C-----G-T 42
OR.7632 -----C-----G-T 42
OR.7587 -----C-----G-T 42
O424 -----C-----G-T 42
OR.3759 -----c-----T-----G-T 42
                                Ile      Asp
OR.7145 -----c-----T-----G-T 42
OR.3473 -----c-----T-----G-T 42
H84 -----c-----T-----G-T 42

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**HPV16 variants
E6**

HPV16R	TTATGCACAGAGCTGCAAACAACACTATACATGATATAATATTAGAATGTGTGTACTGCAAGCAACAGTTACTG	217
HPV16R	LeuCysThrGluLeuGlnThrThrIleHisAspIleIleLeuGluCysValTyrCysLysGlnGlnLeuLeu	
OR. 5110	-----	114
OR. 4724	-----	114
NM. T455	-----	114
O204	-----G-----	114
	Val	
O356	-----	114
OR. 4997	-----	114
O489	-----	114
OR. 0198	-----	114
OR. 9237	-----	114
NM. T197	-----	114
NM. T446	-----	114
O425	-----	114
OR. 6311	-----	114
OR. 8329	-----	114
OR. 6170	-----	114
OR. 4716	-----G-----	114
	Glu	
OR. 7574	-----G-----	114
OR. 2087	-----G-----	114
OR. 5428	-----G-----	114
OR. 8392	-----G-----	114
	Arg	
OR. 1783	-----G-----	114
O462	-----G-----	114
O191	-----G-----	114
NM. 4094	-----	114
OR. 4541	-----	114
OR. 4072	-----	114
NM. 9999	-----	114
NM. T529	-----	114
O512	-----	114
OR. 3136	-----	114
O162	-----	114
O561	-----	114
OR. 1905	-----	114
OR. 6106	-----	114
OR. 7632	-----	114
OR. 7587	-----	114
O424	-----T-----	114
	Tyr	
OR. 3759	-----	114
OR. 7145	-----	114
OR. 3473	-----	114
H84	-----	114

**HPV16 variants
E6**

	5' sj \/ (E6*transcripts)	
HPV16R	CGACGTGAGGTATATGACTTTGCTTTTCGGGATTTATGCATAGTATATAGAGATGGGAATCCATATGCTGTA	289
HPV16R	ArgArgGluValTyrAspPheAlaPheArgAspLeuCysIleValTyrArgAspGlyAsnProTyrAlaVal	
OR. 5110	-----	186
OR. 4724	-----	186
NM. T455	-----	186
O204	-----	186
O356	-----	186
OR. 4997	-----	186
	-A-A-	
	LysAsn	
O489	-----	186
OR. 0198	-----	186
OR. 9237	-----	186
NM. T197	-----	186
NM. T446	-----	186
O425	-----	186
OR. 6311	-----	186
OR. 8329	-----	186
OR. 6170	-----	186
OR. 4716	-----	186
OR. 7574	-----	186
OR. 2087	-----	186
OR. 5428	-----	186
OR. 8392	-----	186
OR. 1783	-----	186
O462	-----	186
O191	-----	186
NM. 4094	-----	186
OR. 4541	-----	186
OR. 4072	-----	186
NM. 9999	-----	186
NM. T529	-----	186
O512	-----	186
OR. 3136	-----	186
O162	-----	186
O561	-----	186
OR. 1905	-----	186
OR. 6106	-----	186
OR. 7632	-----	186
OR. 7587	-----	186
O424	-----	186
OR. 3759	-----	186
OR. 7145	-----	186
OR. 3473	-----	186
H84	-----	186

HPV16R	TGTGATAAATGTTTAAAGTTTTATTCTAAAATTAGTGAGTATAGACATTATTGTTATAGTTTGTATGGAACA	361
HPV16R	CysAspLysCysLeuLysPheTyrSerLysIleSerGluTyrArgHisTyrCysTyrSerLeuTyrGlyThr	
OR. 5110	-----	258
OR. 4724	-----	258
NM. T455	-----	258
O204	-----	258
O356	-----G-----	258
		Val
OR. 4997	-----G-----	258
O489	-----	258
OR. 0198	-----G-----	258
OR. 9237	-----G-----	258
NM. T197	-----G-----	258
NM. T446	-----G-----	258
O425	-----G-----	258
OR. 6311	-----G-----	258
OR. 8329	-----G-----	258
OR. 6170	-----	258
OR. 4716	-----	258
OR. 7574	-----	258
OR. 2087	-----	258
OR. 5428	-----	258
OR. 8392	-----T-----G-----	258
		Tyr
		Val
OR. 1783	-----T-----G-----	258
O462	-----T-----G-----	258
O191	-----T-----G-----	258
NM. 4094	-----T-----G-----	258
OR. 4541	-----T-----G-----	258
OR. 4072	-----T-----G-----	258
NM. 9999	-----T-----G-----	258
NM. T529	-----T-----G-----	258
O512	-----T-----G-----	258
OR. 3136	-----T-----G-----	258
O162	---G-----T-----G-----	258
		Glu
		Tyr
		Val
O561	-----T-----	258
		Tyr
OR. 1905	-----T-----	258
OR. 6106	-----T-----	258
OR. 7632	-----T-----	258
OR. 7587	-----T-----	258
O424	-----T-----	258
OR. 3759	-----T-----	258
OR. 7145	-----T-----	258
OR. 3473	-----T-----	258
H84	-----T-----	258

**HPV16 variants
E6**

	\ / 3' sj (E6*I)	
HPV16R	ACATTAGAACAGCAATACAACAAACCGTTGTGTGATTGTGTAATTAGGTGTATTAAGTGTCAAAGCCACTG	433
HPV16R	ThrLeuGluGlnGlnTyrAsnLysProLeuCysAspLeuLeuIleArgCysIleAsnCysGlnLysProLeu	
OR. 5110	-----	330
OR. 4724	-----	330
NM. T455	-----	330
O204	-----	330
O356	-----	330
OR. 4997	-----	330
O489	-----	330
OR. 0198	-----	330
OR. 9237	-----	330
NM. T197	-----	330
NM. T446	-----	330
O425	-----	330
OR. 6311	-----	330
OR. 8329	-----	330
OR. 6170	-----	330
OR. 4716	-----	330
OR. 7574	-----	330
OR. 2087	-----	330
OR. 5428	-----	330
OR. 8392	-----	330
OR. 1783	-----	330
O462	-----	330
O191	-----	330
NM. 4094	-----	330
OR. 4541	-----	330
OR. 4072	-----	330
NM. 9999	-----	330
NM. T529	-----	330
O512	-----	330
OR. 3136	-----	330
O162	-----	330
O561	-----	330
OR. 1905	-----	330
OR. 6106	-----	330
OR. 7632	-----	330
OR. 7587	-----	330
O424	-----	330
OR. 3759	-----g-----	330
OR. 7145	-----g-----	330
OR. 3473	-----g-----	330
H84	-----g-----	330

**HPV16 variants
E6**

HPV16R	TGTCCTGAAGAAAAGCAAAGACATCTGGACAAAAGCAAAGATTCCATAATATAAGGGGTCGGTGGACCGGT	505
HPV16R	CysProGluGluLysGlnArgHisLeuAspLysLysGlnArgPheHisAsnIleArgGlyArgTrpThrGly	
OR. 5110	-----	402
OR. 4724	-----	402
NM. T455	-----	402
O204	-----	402
O356	-----	402
OR. 4997	-----	402
O489	-----	402
OR. 0198	-----	402
OR. 9237	-----	402
NM. T197	-----	402
NM. T446	-----	402
O425	-----	402
OR. 6311	-----	402
OR. 8329	-----	402
OR. 6170	-----	402
OR. 4716	-----	402
OR. 7574	-----	402
OR. 2087	-----	402
OR. 5428	-----	402
OR. 8392	-----	402
OR. 1783	-----	402
O462	-----	402
O191	-----C-----	402
	Asp	
NM. 4094	-----	402
OR. 4541	-----	402
OR. 4072	-----	402
NM. 9999	-----	402
NM. T529	-----	402
O512	-----	402
OR. 3136	-----	402
O162	-----	402
O561	-----	402
OR. 1905	-----	402
OR. 6106	-----	402
OR. 7632	-----	402
OR. 7587	-----	402
O424	-----	402
OR. 3759	-----	402
OR. 7145	-----	402
OR. 3473	-----	402
H84	-----	402

**HPV16 variants
E6**

```

                                E7 orf start ->
                                \| 3' sj (E6*II)                                <- E6 end
HPV16R      CGATGTATGTCTTGTTCAGATCATCAAGAACACGTAGAGAAACCCAGCTGTAATC      561
HPV16R      $$$ArgAsnProAlaValIle
HPV16R      ArgCysMetSerCysCysArgSerSerArgThrArgArgGluThrGlnLeu$$$
OR. 5110     ----- 456
OR. 4724     ----- 456
NM. T455     ----- 456
O204        ----- 456
O356        ----- 456
OR. 4997     ----- 456
O489        ----- 456
OR. 0198     ----- 456
OR. 9237     ----- 456
NM. T197     ----- 456
NM. T446     ----- 456
O425        ----- 456
OR. 6311     ----- 456
OR. 8329     ----- 456
OR. 6170     ----- 456
OR. 4716     ----- 456
OR. 7574     ----- 456
OR. 2087     ----- 456
OR. 5428     ----- 456
OR. 8392     -----g----- 456
OR. 1783     -----g----- 456
O462        -----g----- 456
O191        -----g----- 456
NM. 4094     -----g----- 456
OR. 4541     -----g----- 456
OR. 4072     -----g----- 456
NM. 9999     -----g----- 456
NM. T529     -----g----- 456
O512        -----G-----g----- 456
                Cys
OR. 3136     ----- 456
O162        ----- 456
O561        ----- 456
OR. 1905     ----- 456
OR. 6106     ----- 456
OR. 7632     ----- 456
OR. 7587     ----- 456
O424        ----- 456
OR. 3759     ----- 456
OR. 7145     ----- 456
OR. 3473     ----- 456
H84         ----- 456

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HPV16 variants
E7

E7 cds ->

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HPV16R ATGCATGGAGATACACCTACATTGCATGAATATATGTTAGATTGCAACCAGAGACAACCTGATCTCTACTGT 633
HPV16R MetHisGlyAspThrProThrLeuHisGluTyrMetLeuAspLeuGlnProGluThrThrAspLeuTyrCys
ALABAMA-B24 ----- 52
ALASKA-C32 ----- 52
ALASKA-C51 ----- 52
CASKI ----- 52
MICHIGAN-B8 ----- 52
PANAMA-136 ----- 52
PANAMA-156 ----- 52
PANAMA-206 ----- 52
PANAMA-349 ----- 52
PANAMA-A12 ----- 52
PANAMA-B4 ----- 52
PANAMA-D6 ----- 52
PANAMA-F15 ----- 52
PANAMA-F43 ----- 52
TB7=A32 ----- 72
TB17=A62 ----- 72
GB13=WV_75 ----- 72
HPK_IB ----- 72
HPK_II ----- 72
B20 ----- 72
GB10=WV_4042 ----- 72
PANAMA-F30 ----- 52
SIHA ----- 52
MISSOURI-B11 ----- 52
PANAMA-C20 ----- 52
O559 ----- 72
BT6 ----- 72
BT11 ----- 72
DT24 ----- 72
                               -T-
                               Ser
BT23 ----- 72
DC141 ----- 72
DC207 ----- 72
DC269 ----- 72
F94_27 ----- 72
F94_143 ----- 72
F94_73 ----- 72
TB6=A27 ----- 72
F94_135 ----- 72
F94_44 ----- 72
F94_113 ----- 72
F94_179 ----- 72
PANAMA-200 ----- 52
TB4=A21 ----- 72
TB8=A36 ----- 72
TB9=A42 ----- 72
TB16=A61 ----- 72
BT7 ----- 72
BT12 ----- 72
BT10 ----- 72
BT20 ----- 72
BT22 ----- 72
O561 ----- 72
B22 ----- 72
TB15=A56 ----- 72
TB1=A6 ----- 72
PANAMA-C10 ----- 52
84 ----- 72
1268 ----- 72
H84 ----- 72
GEORGIA-B9 ----- 52
ALABAMA-B23 ----- 52
BT15 ----- 72
O462 ----- 72
F94_2 ----- 72
                               A
                               Lys
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**HPV16 variants
E7**

HPV16R	TATGAGCAATTAAATGACAGCTCAGAGGAGGAGGATGAAATAGATGGTCCAGCTGGACAAGCAGAACCCGGAC	705
HPV16R	TyrGluGlnLeuAsnAspSerSerGluGluGluAspGluIleAspGlyProAlaGlyGlnAlaGluProAsp	
ALABAMA-B24	-----	124
ALASKA-C32	-----	124
ALASKA-C51	-----	124
CASKI	-----	124
MICHIGAN-B8	-----	124
PANAMA-136	-----	124
PANAMA-156	-----	124
PANAMA-206	-----	124
PANAMA-349	-----	124
PANAMA-A12	-----	124
PANAMA-B4	-----	124
PANAMA-D6	-----	124
PANAMA-F15	-----	124
PANAMA-F43	-----	124
TB7=A32	-----	144
TB17=A62	-----	144
GB13=WV_75	-----	144
HPK_IB	-----	144
HPK_II	-----	144
B20	-----	144
GB10=WV_4042	-----	144
PANAMA-F30	-----a-----	124
SIHA	-----C-----	124
	Phe	
MISSOURI-B11	-----T-----	124
	Leu	
PANAMA-C20	-----c-----	124
O559	-----	144
BT6	-----	144
BT11	-----	144
DT24	-----	144
BT23	-----	144
DC141	-----	144
DC207	-----	144
DC269	-----	144
F94_27	-----C-----	144
	Phe	
F94_143	-----	144
F94_73	-----	144
TB6=A27	-----	144
F94_135	-----G-----	144
	Ser	
F94_44	-----G-----	144
F94_113	-----G-----	144
F94_179	-----a-----	144
PANAMA-200	-----	124
TB4=A21	-----	144
TB8=A36	-----	144
TB9=A42	-----	144
TB16=A61	-----	144
BT7	-----	144
BT12	-----	144
BT10	-----	144
BT20	-----	144
BT22	-----	144
O561	-----	144
B22	-----G-----	144
TB15=A56	-----G-----	144
TB1=A6	-----G-----	144
PANAMA-C10	-----G-----	124
84	-----G-----	144
1268	-----G-----	144
H84	-----G-----	144
GEORGIA-B9	-----	124
ALABAMA-B23	-----	124
BT15	-----	144
O462	-----	144
F94_2	-----	144

**HPV16 variants
E7**

HPV16R	AGAGCCCATTACAATATTGTAACCTTTTGGTTGCAAGTGTGACTCTACGCTTCGGTTGTGCGTACAAAGCACA	777
HPV16R	ArgAlaHisTyrAsnIleValThrPheCysCysLysCysAspSerThrLeuArgLeuCysValGlnSerThr	
ALABAMA-B24	-----	196
ALASKA-C32	-----	196
ALASKA-C51	-----	196
CASKI	-----	196
MICHIGAN-B8	-----	196
PANAMA-136	-----	196
PANAMA-156	-----	196
PANAMA-206	-----	196
PANAMA-349	-----	196
PANAMA-A12	-----	196
PANAMA-B4	-----	196
PANAMA-D6	-----	196
PANAMA-F15	-----	196
PANAMA-F43	-----	196
TB7=A32	-----	216
TB17=A62	-----	216
GB13=WV_75	-----	216
HPK_IB	-----	216
HPK_II	-----	216
B20	-----	216
GB10=WV_4042	-----	216
PANAMA-F30	-----	196
SIHA	-----	196
MISSOURI-B11	-----	196
PANAMA-C20	-----	196
O559	-----	216
BT6	-----	216
BT11	-----	216
DT24	-----	216
BT23	-----	216
DC141	-----	216
DC207	-----	216
DC269	-----	216
F94_27	-----	216
F94_143	-----	216
F94_73	-----	216
TB6=A27	-----	216
F94_135	-----	216
F94_44	-----	216
F94_113	-----	216
F94_179	-----	216
PANAMA-200	-----	196
TB4=A21	-----	216
TB8=A36	-----	216
TB9=A42	-----	216
TB16=A61	-----	216
BT7	-----	216
BT12	-----	216
BT10	-----	216
BT20	-----	216
BT22	-----	216
O561	-----	216
B22	-----	216
TB15=A56	-----	216
TB1=A6	-----	216
PANAMA-C10	-----	196
84	-----	216
1268	-----	216
H84	-----	216
GEORGIA-B9	-----c-----	196
ALABAMA-B23	-----c-----	196
BT15	-----c-----	216
O462	-----c-----	216
F94_2	-----c-----	216

**HPV16 variants
E7**

HPV16R	CACGTAGACATTTCGTACTTTGGAAGACCTGTTAATGGGCACACTAGGAATTGTGTGCCCATCTGTTCTCAG	849
HPV16R	HisValAspIleArgThrLeuGluAspLeuLeuMetGlyThrLeuGlyIleValCysProIleCysSerGln	
ALABAMA-B24	-----	220
ALASKA-C32	-----	220
ALASKA-C51	-----	220
CASKI	-----	220
MICHIGAN-B8	-----	220
PANAMA-136	-----	220
PANAMA-156	-----	220
PANAMA-206	-----	220
PANAMA-349	-----	220
PANAMA-A12	-----	220
PANAMA-B4	-----	220
PANAMA-D6	-----	220
PANAMA-F15	-----	220
PANAMA-F43	-----	220
TB7=A32	-----	287
TB17=A62	-----	276
GB13=WV_75	-----	288
HPK_IB	-----	288
HPK_II	-----	288
B20	-----	288
GB10=WV_4042	-----	265
PANAMA-F30	-----	220
SIHA	-----	220
MISSOURI-B11	-----	220
PANAMA-C20	-----	220
O559	-----c-----c-----	288
BT6	-----	288
BT11	-----	288
DT24	-----	288
BT23	-----	288
DC141	-----	288
DC207	-----	288
DC269	-----	288
F94_27	-----	288
F94_143	-----	288
F94_73	-----	288
TB6=A27	-----T-----	276
	Cys	
F94_135	-----	288
F94_44	-----c-----c-----	288
F94_113	-----c-----c-----	288
F94_179	-----c-----c-----	288
PANAMA-200	-----c---g-----	220
TB4=A21	-----c---g-----	287
TB8=A36	-----c---g-----	287
TB9=A42	-----c---g-----	279
TB16=A61	-----c---g-----	276
BT7	-----c---g-----	288
BT12	-----c---g-----	288
BT10	-----c---g-----	288
BT20	-----c---g-----	288
BT22	-----c---g-----	288
O561	-----c---g-----	288
B22	-----c---g-----	287
TB15=A56	-----c---g-----	276
TB1=A6	-----c---g-----	240
PANAMA-C10	-----c---g-----	220
84	-----c---g-----	288
1268	-----c---g-----	288
H84	-----c---g-----	288
GEORGIA-B9	-----c---g-----	220
ALABAMA-B23	-----c---g-----	220
BT15	-----c---g-----	288
O462	-----c---g-----	288
F94_2	-----c---g-----	288

HPV16 variants
E7, E1

E1 orf start ->		-> E1 cds	
	<- E7 end	5' sj \/	
HPV16R	AAACCATAATCTACCATGGCTGATCTGCAGGTACCAATGGGGAAGAGGGTACGGGATGTAATGGATGGTTT	LysPro\$\$\$SerThrMetAlaAspProAlaGlyThrAsnGlyGluGluGlyThrGlyCysAsnGlyTrpPhe	921
HPV16R	-----		294
GB13=WV_75	-----		294
HPK_IB	-----		294
HPK_II	-----		294
B20	-		289
O559	-----		297
BT6	-----		297
BT11	-----		297
DT24	-----		297
BT23	-----		297
DC141	-----		297
DC207	-----		297
DC269	-----		297
F94_27	-----		297
F94_143	-----		297
F94_73	-----		297
F94_135	-----		297
F94_44	-----		297
F94_113	-----		297
F94_179	-----		297
BT7	-----		297
BT12	-----		297
BT10	-----		297
BT20	-----		297
BT22	-----		297
O561	-----		297
84	-----		297
1268	-----		297
H84	-----		297
BT15	-----		297
O462	-----		297
F94_2	-----		297
HPV16R	TATGTAGAGGCTGTAGTGGAAAAAAAAACAGGGGATGCTATATCAGATGACGAGAACGAAAATGCAGTGAT	TyrValGluAlaValValGluLysLysThrGlyAspAlaIleSerAspAspGluAsnGluAsnAspSerAsp	993
HPV16R	ACAGGTGAAGATTTGGTAGATTTTATAGTAAATGATAATGATTATTTAACACAGGCAGAAACAGAGACAGCA	ThrGlyGluAspLeuValAspPheIleValAsnAspAsnAspTyrLeuThrGlnAlaGluThrGluThrAla	1065
HPV16R	CATGCGTTGTTTACTGCACAGGAAGCAAAACAACATAGAGATGCAGTACAGGTTCTAAAACGAAAGTATTTG	HisAlaLeuPheThrAlaGlnGluAlaLysGlnHisArgAspAlaValGlnValLeuLysArgLysTyrLeu	1137
HPV16R	GGTAGTCCACTTAGTGATATTAGTGGATGTGTAGACAATAATATTAGTCCTAGATTTAAAGCTATATGTATA	∨ additional 'G' in wild-type absent from original clone	1209
HPV16R	GAAAAACAAAGTAGAGCTGCAAAAAGGAGATTATTTGAAAGCGAAGACAGCGGGTATGGCAATACTGAAGTG	GlySerProLeuSerAspIleSerGlyCysValAspAsnAsnIleSerProArgLeuLysAlaIleCysIle	1281
HPV16R	GAAAAACAAAGTAGAGCTGCAAAAAGGAGATTATTTGAAAGCGAAGACAGCGGGTATGGCAATACTGAAGTG	GluLysGlnSerArgAlaAlaLysArgArgLeuPheGluSerGluAspSerGlyTyrGlyAsnThrGluVal	
	5' sj \/		
HPV16R	GAAACTCAGCAGATGTTACAGGTAGAAGGGCGCCATGAGACTGAAACACCATGTAGTCAGTATAGTGGTGGGA	GluThrGlnGlnMetLeuGlnValGluGlyArgHisGluThrGluThrProCysSerGlnTyrSerGlyGly	1353
HPV16R	AGTGGGGGTGGTTGCAGTCAGTACAGTAGTGAAGTGGGGGAGAGGGTGTAGTGAAAGACACACTATATGC	SerGlyGlyGlyCysSerGlnTyrSerSerGlySerGlyGlyGluGlyValSerGluArgHisThrIleCys	1425
HPV16R	CAAACACCACTTACAAATATTTTAAATGTACTAAAACTAGTAATGCAAAGGCAGCAATGTTAGCAAAATTT	GlnThrProLeuThrAsnIleLeuAsnValLeuLysThrSerAsnAlaLysAlaAlaMetLeuAlaLysPhe	1497
HPV16R	AAAGAGTTATACGGGGTGAGTTTTTTCAGAATTAGTAAGACCATTTAAAAGTAATAAATCAACGTGTGCGAT	LysGluLeuTyrGlyValSerPheSerGluLeuValArgProPheLysSerAsnLysSerThrCysCysAsp	1569
HPV16R	TGGTGTATTGCTGCATTTGGACTTACACCCAGTATAGCTGACAGTATAAAAACTATTACAACAATATTGT	TrpCysIleAlaAlaPheGlyLeuThrProSerIleAlaAspSerIleLysThrLeuLeuGlnGlnTyrCys	1641
HPV16R	TTATATTTACACATTCAAAGTTTAGCATGTTTCATGGGGAATGGTTGTGTTACTATTAGTAAGATATAAATGT	LeuTyrLeuHisIleGlnSerLeuAlaCysSerTrpGlyMetValValLeuLeuLeuValArgTyrLysCys	1713
HPV16R	GGAAAAAATAGAGAAACAATTGAAAAATTGCTGTCTAAACTATTATGTGTGTCTCCAATGTGTATGATGATA	GlyLysAsnArgGluThrIleGluLysLeuLeuSerLysLeuLeuCysValSerProMetCysMetMetIle	1785

**HPV16 variants
E1, E2, E4**

HPV16R HPV16R	GAGCCTCCAAAATTGCGTAGTACAGCAGCAGCATTATATTGGTATAAAAACAGGTATATCAAATATTAGTGAA GluProProLysLeuArgSerThrAlaAlaAlaLeuTyrTrpTyrLysThrGlyIleSerAsnIleSerGlu	1857
HPV16R HPV16R	GTGTATGGAGACACGCCAGAATGGATACAAAAGCAAACAGTATTACAACATAGTTTTAATGATTGTACATTT ValTyrGlyAspThrProGluTrpIleGlnArgGlnThrValLeuGlnHisSerPheAsnAspCysThrPhe	1929
HPV16R HPV16R	GAATTATCACAGATGGTACAATGGGCTACGATAATGACATAGTAGACGATAGTAAAATTCATATAAAATAT GluLeuSerGlnMetValGlnTrpAlaTyrAspAsnAspIleValAspAspSerGluIleAlaTyrLysTyr	2001
HPV16R HPV16R	GCACAATTGGCAGACACTAATAGTAATGCAAGTGCCTTTCTAAAAAGTAATTCACAGGCCAAAATTTGTAAAG AlaGlnLeuAlaAspThrAsnSerAsnAlaSerAlaPheLeuLysSerAsnSerGlnAlaLysIleValLys	2073
HPV16R HPV16R	GATTGTGCAACAATGTGTAGACATTATAAACGAGCAGAAAAAAACAAATGAGTATGAGTCAATGGATAAAA AspCysAlaThrMetCysArgHisTyrLysArgAlaGluLysLysGlnMetSerMetSerGlnTrpIleLys	2145
HPV16R HPV16R	TATAGATGTGATAGGGTAGATGATGGAGGTGATTGGAAGCAAATTTTATGTTTTTAAGGTATCAAGGTGTA TyrArgCysAspArgValAspAspGlyGlyAspTrpLysGlnIleValMetPheLeuArgTyrGlnGlyVal	2217
HPV16R HPV16R	GAGTTTTATGTCATTTTTAACTGCATTAAAAAGATTTTTGCAAGGCATACCTAAAAAAATTCATATTACTA GluPheMetSerPheLeuThrAlaLeuLysArgPheLeuGlnGlyIleProLysLysAsnCysIleLeuLeu	2289
HPV16R HPV16R	TATGGTGCAGCTAACACAGGTAAATCATTATTTGGTATGAGTTTAAATGAAATTTCTGCAAGGGTCTGTAATA TyrGlyAlaAlaAsnThrGlyLysSerLeuPheGlyMetSerLeuMetLysPheLeuGlnGlySerValIle	2361
HPV16R HPV16R	TGTTTTGTAAATTTCTAAAAGCCATTTTTGGTTACAACCATTAGCAGATGCCAAAATAGGTATGTTAGATGAT CysPheValAsnSerLysSerHisPheTrpLeuGlnProLeuAlaAspAlaLysIleGlyMetLeuAspAsp	2433
HPV16R HPV16R	GCTACAGTGCCTGTGGAACTACATAGATGACAATTTAAGAAATGCATTGGATGGAAATTTAGTTTCTATG AlaThrValProCysTrpAsnTyrIleAspAspAsnLeuArgAsnAlaLeuAspGlyAsnLeuValSerMet	2505
HPV16R HPV16R	GATGTAAGCATAGACCATTGGTACAACATAAATGCCCTCCATTATTAATTACATCTAACATTAATGCTGGT AspValLysHisArgProLeuValGlnLeuLysCysProProLeuLeuIleThrSerAsnIleAsnAlaGly	2577
	\ / 3' sj	
HPV16R HPV16R	ACAGATCTAGGTGGCCTTATTTACATAATAGATTGGTGGTGTTCACATTTCTCAATGAGTTTCCATTTGAC ThrAspSerArgTrpProTyrLeuHisAsnArgLeuValValPheThrPheProAsnGluPheProPheAsp	2649
	\ / 3' sj (E2,E5)	
HPV16R HPV16R	GAAAACGGAAATCCAGTGTATGAGCTTAATGATAAGAACTGGAAATCCTTTTTCTCAAGGACGTGGTCCAGA GluAsnGlyAsnProValTyrGluLeuAsnAspLysAsnTrpLysSerPhePheSerArgThrTrpSerArg	2721
	E2 orf start -> E2 cds ->	
HPV16R HPV16R HPV16R	TTAAGTTTGCACGAGGACGAGGACAAGAAAACGATGGAGACTCTTTGCCAACGTTAAATGTGTGTCAGGAC LeuSerLeuHisGluAspGluAspLysGluAsnAspGlyAspSerLeuProThrPheLysCysValSerGlyG \$\$\$ValCysThrArgThrArgThrArgLysThrMetGluThrLeuCysGlnArgLeuAsnValCysGlnAsp	2794
	<- E1 end	
HPV16R HPV16R HPV16R	AAAATACTAACACATTATGAAAATGATAGTACAGACCTACGTGACCATATAGACTATTGGAAACACATGCGC lnAsnThrAsnThrLeu\$\$\$ LysIleLeuThrHisTyrGluAsnAspSerThrAspLeuArgAspHisIleAspTyrTrpLysHisMetArg	2866
HPV16R HPV16R	CTAGAATGTGCTATTTATTACAAGGCCAGAAAATGGGATTTAAACATATTAACCACCAAGTGGTGCCAA LeuGluCysAlaIleTyrTyrLysAlaArgGluMetGlyPheLysHisIleAsnHisGlnValValProThr	2938
HPV16R HPV16R	CTGGCTGTATCAAAGAATAAAGCATTACAAGCAATTGAACTGCAACTAACGTTAGAAAACAATATAACTCA LeuAlaValSerLysAsnLysAlaLeuGlnAlaIleGluLeuGlnLeuThrLeuGluThrIleTyrAsnSer	3010
HPV16R HPV16R	CAATATAGTAATGAAAAGTGGACATTACAAGACGTTAGCCTTGAAGTGTATTTAACTGCACCAACAGGATGT GlnTyrSerAsnGluLysTrpThrLeuGlnAspValSerLeuGluValTyrLeuThrAlaProThrGlyCys	3082
HPV16R HPV16R	ATAAAAAACATGGATATACAGTGGAAAGTGCAGTTTGTAGGAGACATATGCAATACAATGCATTATACAAAC IleLysLysHisGlyTyrThrValGluValGlnPheAspGlyAspIleCysAsnThrMetHisTyrThrAsn	3154
HPV16R HPV16R	TGGACACATATATATATTTGTGAAGAAGCATCAGTAACTGTGGTAGAGGGTCAAGTTGACTATTATGGTTTA TrpThrHisIleTyrIleCysGluGluAlaSerValThrValValGluGlyGlnValAspTyrTyrGlyLeu	3226
HPV16R HPV16R	TATTATGTTTCATGAAGGAATACGAACATATTTGTGCAGTTTAAAGATGATGCAGAAAAATATAGTAAAAAT TyrTyrValHisGluGlyIleArgThrTyrPheValGlnPheLysAspAspAlaGluLysTyrSerLysAsn	3298
	E4 orf start ->(NH ₂ terminus unknown)\ / 3' sj	
HPV16R HPV16R HPV16R	AAAGTATGGGAAGTTCATGCGGGTGTGTCAGTAATATTATGTCCTACATCTGTGTTTAGCAGCAACGAAGTA LysValTrpGluValHisAlaGlyGlyGlnValIleLeuCysProThrSerValPheSerSerAsnGluVal \$\$\$TyrTyrValLeuHisLeuCysLeuAlaAlaThrLysTy	3370
HPV16R HPV16R HPV16R	TCCTCTCTGAAATTATTAGGCAGCACTTGGCCAACCACCCCGCGACCCATACCAAGCCGTGCGCTTG SerSerProGluIleIleArgGlnHisLeuAlaAsnHisProAlaAlaThrHisThrLysAlaValAlaLeu rProLeuLeuLysLeuLeuGlySerThrTrpProThrThrProProArgProIleProLysProSerProTr	3442

**HPV16 variants
E2, E4, E5**

HPV16R	GGCACCGAAGAAACACAGACGACTATCCAGCGACCAAGATCAGAGCCAGACACCGGAAACCCCTGCCACACC	3514
HPV16R	GlyThrGluGluThrGlnThrThrIleGlnArgProArgSerGluProAspThrGlyAsnProCysHisThr	
HPV16R	pAlaProLysLysHisArgArgLeuSerSerAspGlnAspGlnSerGlnThrProGluThrProAlaThrPr	
HPV16R	ACTAAGTTGTTGCACAGAGACTCAGTGGACAGTGCCTCAATCCTCACTGCATTTAACAGCTCACACAAAGGA	3586
HPV16R	ThrLysLeuLeuHisArgAspSerValAspSerAlaProIleLeuThrAlaPheAsnSerSerHisLysGly	
HPV16R	oLeuSerCysCysThrGluThrGlnTrpThrValLeuGlnSerSerLeuHisLeuThrAlaHisThrLysAs	
	5' sj \/ <- E4 end	
HPV16R	CGGATTAAGTGAATAGTAACACTACACCCATAGTACATTTAAAAGGTGATGCTAATACTTTAAAATGTTTA	3658
HPV16R	ArgIleAsnCysAsnSerAsnThrThrProIleValHisLeuLysGlyAspAlaAsnThrLeuLysCysLeu	
HPV16R	pGlyLeuThrValIleValThrLeuHisPro\$\$\$	
HPV16R	AGATATAGATTTAAAAGCATGTACATTGTACTGTCAGTGTCTGCTACATGGCATTGGACAGGACATAAT	3730
HPV16R	ArgTyrArgPheLysLysHisCysThrLeuTyrThrAlaValSerSerThrTrpHisTrpThrGlyHisAsn	
HPV16R	GTAAAACATAAAAGTGCAATTGTTACTTACATATGATAGTGAATGGCAACGTGACCAATTTTGTCTCAA	3802
HPV16R	ValLysHisLysSerAlaIleValThrLeuThrTyrAspSerGluTrpGlnArgAspGlnPheLeuSerGln	
	<- E2 end	
E5 orf start ->	E5 cds ->	
HPV16R	GTTAAAATACCAAAAACACTATTACAGTGTCTACTGGATTTATGTCTATATGACAAAATCTTGATACTGCATCC	3873
HPV16R	\$\$\$AsnThrLysAsnTyrTyrSerValTyrTrpIleTyrValTyrMetThrAsnLeuAspThrAlaSer	
HPV16R	ValLysIleProLysThrIleThrValSerThrGlyPheMetSerIle\$\$\$	
DT24	-----	24
BT11	-----	24
BT6	-----a-----	24
CASKI	-----A-----	24
	Tyr	
SB10	-----	24
SB13	-----	24
SB17	-----	24
SB7	-----	24
DC207	-----	24
A00446	-----	24
DC141	-----	24
SB2	-----	24
BT23	-----	24
DC269	-----	24
SB5	-----A-----	24
SIHA	-----	24
SB16	-----c-----	24
BT15	-----c-----	24
BT7	-----c-----	24
SB21A	-----c-----	24
BT22	-----c-----nA-----	24
	Thr	
BT10	-----c-----A-----	24
BT20	-----c-----A-----	24
BT12	-----c-----A-----	24
TB8	-----c-----A-----	24
TB4	-----c-----A-----	24
TB16	-----c-----CA-----	24
TB13	-----c-----A-----	24

**HPV16 variants
E5**

HPV16R	ACAACATTACTGGCGTGCCTTTTGTGCTTTGCTTTTGTGTGCTTTTGTGTGCTGCCTATTAATACGTCCGCTG	3945
HPV16R	ThrThrLeuLeuAlaCysPheLeuLeuCysPheCysValLeuLeuCysValCysLeuLeuIleArgProLeu	
DT24	-----	96
BT11	-----	96
BT6	-----	96
CASKI	-----	96
SB10	G-----G-----	96
	Ala-----Val	
SB13	-----	96
SB17	-----	96
SB7	-----	96
DC207	-----	96
A00446	-----	96
DC141	-----	96
SB2	-----	96
BT23	-----	96
DC269	-----t-----	96
SB5	-----	96
SIHA	-----A-----	96
	Ile	
SB16	-----	96
BT15	-----	96
BT7	-----	96
SB21A	-----	96
BT22	-----	96
BT10	-----	96
BT20	-----	96
BT12	-----	96
TB8	-----	96
TB4	-----	96
TB16	-----	96
TB13	-----	96
HPV16R	CTTTTGTCTGTGTCTACATACACATCATTATAATAATATTGGTATTACTATTTGTGGATAACAGCAGCCTCTGCG	4017
HPV16R	LeuLeuSerValSerThrTyrThrSerLeuIleIleLeuValLeuLeuLeuTrpIleThrAlaAlaSerAla	
DT24	-----	168
BT11	-----	168
BT6	-----	168
CASKI	-----C-----	168
	Leu	
SB10	-----C-----	168
SB13	-----C--c-----	168
SB17	-----C-----	168
SB7	-----C-----	168
DC207	-----C-----	168
A00446	-----C-----	168
DC141	-----C-----	168
SB2	-----C-----	168
BT23	-----C-----	168
DC269	-----C-----	168
SB5	-----C-----	168
	Pro Leu	
SIHA	-----C-----G-----	168
	Leu Val	
SB16	-----C-----G-----a	168
BT15	-----C-----G-----a	168
BT7	-----C-----G-----	168
SB21A	-----C-----G-----	168
BT22	-----C-----t-----	168
	Leu	
BT10	-----C-----t-----	168
BT20	-----C-----t-----	168
BT12	-----C-----t-----	168
TB8	-----C-----t-----	168
TB4	-----C-----t-----	168
TB16	-----C-----t-----	168
TB13	-----G-----c-----t-----T-----	168
	Val Phe	

HPV16 variants
E5

HPV16R	TTTAGGTGTTTTATTGTATATATTATATTTGTTTATATACCATTATTTTTAATACATACACATGCAGCCTTT	4089
HPV16R	PheArgCysPheIleValTyrIleIlePheValTyrIleProLeuPheLeuIleHisThrHisAlaArgPhe	
DT24	-----	240
BT11	-----	240
BT6	-----	240
CASKI	-----G-----	240
	Val	
SB10	-----G-----t-----	240
SB13	-----C-G-----t-----	240
	ThrVal	
SB17	-----G-C-----t-----	240
	ValSer	
SB7	-----G-----t-----	240
	Val	
DC207	-----G-----	240
A00446	-----G-----	240
DC141	-----G-----	240
SB2	-----g-----G-----	240
BT23	-----G-----n-----	240
DC269	-----G-----	240
SB5	-----G-----	240
SIHA	-----G-----	240
SB16	-----G-----c-----	240
BT15	-----G-----	240
BT7	-----G-----c-----	240
SB21A	-----G-----c-----c-----	240
BT22	-----T-----n-----	240
	Leu	
BT10	-----T-----g-----	240
BT20	-----T-----	240
BT12	-----T-----	240
TB8	-----T-----G-----	240
	Leu Leu	
TB4	-----T-----c-----	240
	Leu	
TB16	-----T-----c-----	240
TB13	-----T-----c-----	240
	<- E5 end L2 orf start ->	
HPV16R	TTAATTACATAATGTATATGTACATAATGTAATTGTTACATATAATTGTTGTATACCATAACTTACTATTTTT	4161
HPV16R	LeuIleThr\$\$\$CysIleCysThr\$\$\$CysAsnCysTyrIle\$\$\$LeuLeuTyrThrIleThrTyrTyrPhe	
DT24	-----	252
BT11	-----	252
BT6	-----	252
CASKI	-----	252
SB10	-----	252
SB13	-----	252
SB17	-----	252
SB7	-----	252
DC207	-----	252
A00446	-----	252
DC141	-----	252
SB2	-----	252
BT23	-----	252
DC269	-----	252
SB5	-----	252
SIHA	-----	252
SB16	-----	252
BT15	-----	252
BT7	-----	252
SB21A	-----	252
BT22	-----	252
BT10	-----	252
BT20	-----	252
BT12	-----	252
TB8	-----	252
TB4	-----	252
TB16	-----	252
TB13	-----	252

HPV16 variants
L2

	early poly-A signal -> <-	
HPV16R	TTCTTTTATTTTCATATATAATTTTTTTTTTGTGGTTGTTGTTGTTTAAATAAACTGTTATTACTTA	4233
HPV16R	PhePhePheIlePheIleTyrAsnPhePhePheCysLeuPheValCysPheLeuIleAsnCysTyrTyrLeu	
L2 cds ->	signal -> <-	
HPV16R	ACAATGCGACACAAACGTTCTGCAAAACGCACAAAACGTGCATCGGCTACCCAACCTTATAAAAACATGCAAA	4305
HPV16R	ThrMetArgHisLysArgSerAlaLysArgThrLysArgAlaSerAlaThrGlnLeuTyrLysThrCysLys	
BT15	-----	69
BT12	-----	69
BT20	-----	69
DC269	-----	69
DC141	-----	69
BT23	-----	69
BT6	-----	69
BT11	-----	69
DT24	-----	69
DC207	-----	69
BT7	-----	69
BT22	-----	69
BT10	-----	69
T45	-----	42
T17	-----	42
S83	-----	42
S23	-----	42
OR. 2087	-----	33
OR. 7574	-----	33
OR. 4716	-----	33
OR. 5428	-----	33
OR. 4724	-----	33
114B	-----	69
OR. 5110	-----	33
OR. 6170	-----	33
S108	-----	42
OR. 4997	-----	33
OR. 6311	-----	33
OR. 8329	-----	33
114K	-----	69
S29	-----	42
NM. T455	-----	33
S93	-----	42
S27	-----	42
OR. 9237	-----	33
NM. T446	-----	33
NM. T197	-----	33
OR. 0198	-----	33
OR. 1905	-----c-----	33
OR. 6106	-----c-----	33
OR. 7587	-----c-----	33
OR. 7632	-----c-----	33
OR. 3759	-----c-----	33
OR. 3473	-----c-----	33
1194	-----c-----	69
OR. 7145	-----c-----	33
OR. 3136	-----c-----	33
NM. T529	-----c-----	33
NM. 9999	-----c-----	33
OR. 4541	-----c-----	33
NM. 4094	-----c-----	33

HPV16 variants
L2

HPV16R	CAGGCAGGTACATGTCCACCTGACATTATACCTAAGGTTGAAGGCAAACTATTGCTGATCAAATATTACAA	4377
HPV16R	GlnAlaGlyThrCysProProAspIleIleProLysValGluGlyLysThrIleAlaAspGlnIleLeuGln	
BT15	-----	141
BT12	-----	141
BT20	-----	141
DC269	-----	141
DC141	-----	141
BT23	-----	141
BT6	-----	141
BT11	-----	141
DT24	-----	141
DC207	-----	141
BT7	-----	141
BT22	-----	141
BT10	-----	141
T45	-----	114
T17	-----	114
S83	-----	114
S23	-----	114
OR. 2087	-----	105
OR. 7574	-----	105
OR. 4716	-----	105
OR. 5428	-----	105
OR. 4724	-----	105
114B	-----	141
OR. 5110	-----	105
OR. 6170	-----	105
S108	-----	114
OR. 4997	-----	105
OR. 6311	-----g-----	105
OR. 8329	-----	105
114K	-----	141
S29	-----	114
NM. T455	-----	105
S93	-----	114
S27	-----	114
OR. 9237	-----	105
NM. T446	-----	105
NM. T197	-----	105
OR. 0198	-----	105
OR. 1905	-----a-----	105
OR. 6106	-----a-----	105
OR. 7587	-----a-----	105
OR. 7632	-----a-----	105
OR. 3759	-----	105
OR. 3473	-----	105
1194	-----	141
OR. 7145	-----	105
OR. 3136	-----	105
NM. T529	-----	105
NM. 9999	-----	105
OR. 4541	-----	105
NM. 4094	-----	105

**HPV16 variants
L2**

HPV16R	TATGGAAGTATGGGTGTATTTTTTGGTGGGTTAGGAATTGGAACAGGGTCGGGTACAGGCGGACGCACTGGG	4449
HPV16R	TyrGlySerMetGlyValPhePheGlyGlyLeuGlyIleGlyThrGlySerGlyThrGlyGlyArgThrGly	
BT15	-----	186
BT12	-----	186
BT20	-----	186
DC269	-----	186
DC141	-----	186
BT23	-----	186
BT6	-----	186
BT11	-----	186
DT24	-----	186
DC207	-----	186
BT7	-----	186
BT22	-----	186
BT10	-----	186
T45	-----	186
T17	-----	186
S83	-----	186
S23	-----	186
OR. 2087	-----	177
OR. 7574	-----	177
OR. 4716	-----	177
OR. 5428	-----	177
OR. 4724	-----	177
114B	-----	213
OR. 5110	-----	177
OR. 6170	-----g-----	177
S108	-----	186
OR. 4997	-----	177
OR. 6311	-----	177
OR. 8329	-----	177
114K	-----	213
S29	-----c-----	186
NM. T455	-----c-----	177
S93	-----	186
S27	-----	186
OR. 9237	-----	177
NM. T446	-----	177
NM. T197	-----	177
OR. 0198	-----	177
OR. 1905	-----a-----	177
OR. 6106	-----a-----	177
OR. 7587	-----a-----	177
OR. 7632	-----a-----	177
OR. 3759	-----a-----t-----	177
OR. 3473	-----t-----	177
1194	-----t-----	213
OR. 7145	-----t-----	177
OR. 3136	-----t-----	177
NM. T529	-----t-----	177
NM. 9999	-----t-----	177
OR. 4541	-----t-----	177
NM. 4094	-----t-----	177

HPV16 variants
L2

HPV16R	TATATTCCATTGGGAACAAGGCTCCACAGCTACAGATACACTTGCTCCTGTAAGACCCCTTTAACAGTA	4521
HPV16R	TyrIleProLeuGlyThrArgProProThrAlaThrAspThrLeuAlaProValArgProProLeuThrVal	
T45	-----	258
T17	-----	258
S83	-----	258
S23	-----	258
OR. 2087	-----	249
OR. 7574	-----	249
OR. 4716	-----	249
OR. 5428	-----	249
OR. 4724	-----	249
114B	-----	285
OR. 5110	-----	249
OR. 6170	-----	249
S108	-----	258
OR. 4997	-----	249
OR. 6311	-----	249
OR. 8329	-----	249
114K	-----	285
S29	-----	258
NM. T455	-----	249
S93	-----a-----	258
S27	-----	258
OR. 9237	-----	249
NM. T446	-----	249
NM. T197	-----	249
OR. 0198	-----a-----	249
OR. 1905	-----a-----	249
OR. 6106	-----a-----	249
OR. 7587	-----a-----	249
OR. 7632	-----a-----	249
OR. 3759	-----a-----g--	249
OR. 3473	-----a-----g--	249
1194	-----a-----g--	285
OR. 7145	-----a-----g--	249
OR. 3136	--c-----a-----	249
NM. T529	--c-----a-----	249
NM. 9999	--c-----a-----t-----	249
OR. 4541	--c-----a-----	249
NM. 4094	--c-----a-----	249

**HPV16 variants
L2**

HPV16R	GATCCTGTGGGCCCTTCTGATCCTTCTATAGTTTCTTTAGTGAAGAACTAGTTTTATTGATGCTGGTGCA	4593
HPV16R	AspProValGlyProSerAspProSerIleValSerLeuValGluGluThrSerPheIleAspAlaGlyAla	
T45	-----	330
T17	-----	330
S83	-----	330
S23	-----	330
OR. 2087	-----	321
OR. 7574	-----	321
OR. 4716	-----	321
OR. 5428	-----	321
OR. 4724	-----	321
114B	-----	357
OR. 5110	-----	321
OR. 6170	-----	321
S108	-----	330
OR. 4997	-----	321
OR. 6311	-----	321
OR. 8329	-----	321
114K	-----	357
S29	-----c-----	330
NM. T455	-----	321
S93	-----	330
S27	-----	330
OR. 9237	-----	321
NM. T446	-----	321
NM. T197	-----	321
OR. 0198	-----	321
OR. 1905	-----	321
OR. 6106	-----	321
OR. 7587	-----	321
OR. 7632	-----	321
OR. 3759	-----g-----	321
OR. 3473	-----g-----g-----	321
1194	-----g-----g-----	357
OR. 7145	-----g-----g-----	321
OR. 3136	-----	321
NM. T529	-----g-----	321
NM. 9999	-----	321
OR. 4541	-----	321
NM. 4094	-----	321

**HPV16 variants
L2**

HPV16R	CCAACATCTGTACCTTCCATTCCCCAGATGTATCAGGATTTAGTATTACTACTTCAACTGATACCACACCT	4665
HPV16R	ProThrSerValProSerIleProProAspValSerGlyPheSerIleThrThrSerThrAspThrThrPro	
T45	-----	402
T17	-----	402
S83	-----	402
S23	-----	402
OR. 2087	-----	393
OR. 7574	-----	393
OR. 4716	-----	393
OR. 5428	-----	393
OR. 4724	-----	393
114B	-----	429
OR. 5110	-----	393
OR. 6170	-----	393
S108	-----	402
OR. 4997	-----	393
OR. 6311	-----	393
OR. 8329	-----	393
114K	-----	429
S29	-----	402
NM. T455	-----	393
S93	-----	402
S27	-----	402
OR. 9237	-----c-----	393
NM. T446	-----c-----	393
NM. T197	-----c-----	393
OR. 0198	-----c-----	393
OR. 1905	-----C-----a-----	393
	Pro	
OR. 6106	-----C-----a-----	393
OR. 7587	-----C-----c-a-----	393
OR. 7632	-----C-----c-a-----	393
OR. 3759	-----C-----a-----	393
OR. 3473	-----C-----a-----	393
1194	-----C-----a-----	429
OR. 7145	-----C-----a-----	393
OR. 3136	-----C-----a-----	393
NM. T529	-----cC-----a-----	393
NM. 9999	-----cC-----a-----	393
OR. 4541	-----cC-----a-----	393
NM. 4094	-----cC-----a-----	393

**HPV16 variants
L2**

HPV16R	GCTATATTAGATATTAATAATACTGTTACTACTGTTACTACACATAATAATCCCACTTTCACTGACCCATCT	4737
HPV16R	AlaIleLeuAspIleAsnAsnThrValThrThrValThrThrHisAsnAsnProThrPheThrAspProSer	
T45	-----	474
T17	-----	474
S83	-----	474
S23	-----t-----	474
OR. 2087	-----t-----	465
OR. 7574	-----t-----	465
OR. 4716	-----t-----	465
OR. 5428	-----	465
OR. 4724	-----	465
114B	-----	501
OR. 5110	-----	465
OR. 6170	-----	465
S108	-----	474
OR. 4997	-----	465
OR. 6311	-----	465
OR. 8329	-----	465
114K	-----	501
S29	-----	474
NM. T455	-----t-----	465
S93	-----	474
S27	-----	474
OR. 9237	-----	465
NM. T446	-----	465
NM. T197	-----	465
OR. 0198	-----	465
OR. 1905	-----t-----	465
OR. 6106	-----t-----	465
OR. 7587	-----t-----	465
OR. 7632	-----t-----	465
OR. 3759	-----t-----	465
OR. 3473	-----t-----	465
1194	-----	501
OR. 7145	-----t-----	465
OR. 3136	-----t-----	465
NM. T529	-----t-----	465
NM. 9999	-----t-----	465
OR. 4541	-----t-----	465
NM. 4094	-----t-----	465

**HPV16 variants
L2**

HPV16R	GTATTGCAGCCTCCAACACCTGCAGAAACTGGAGGGCATTTCACCTTTCATCATCCACTATTAGTACACAT	4809
HPV16R	ValLeuGlnProProThrProAlaGluThrGlyGlyHisPheThrLeuSerSerSerThrIleSerThrHis	
T45	-----	546
T17	-----	546
S83	-----	546
S23	-----	546
OR. 2087	-----	537
OR. 7574	-----	537
OR. 4716	-----	537
OR. 5428	-----	537
OR. 4724	-----	537
114B	-----	573
OR. 5110	-----	537
OR. 6170	-----	537
S108	-----	546
OR. 4997	-----	537
OR. 6311	-----	537
OR. 8329	-----	537
114K	-----	573
S29	-----	546
NM. T455	-----	537
S93	-----	546
S27	-----	546
OR. 9237	-----	537
NM. T446	-----	537
NM. T197	-----	537
OR. 0198	-----	537
OR. 1905	-----	537
OR. 6106	-----	537
OR. 7587	-----	537
OR. 7632	-----	537
OR. 3759	-----	537
OR. 3473	-----	537
1194	-----	573
OR. 7145	-----	537
OR. 3136	-----	537
NM. T529	-----	537
NM. 9999	-----	537
OR. 4541	-----	537
NM. 4094	-----	537

**HPV16 variants
L2**

HPV16R	AATTATGAAGAAATTCCTATGGATACATTTATTGTTAGCACAAACCCTAACACAGTAACTAGTAGCACACCC	4881
HPV16R	AsnTyrGluGluIleProMetAspThrPheIleValSerThrAsnProAsnThrValThrSerSerThrPro	
T45	-----	618
T17	-----	618
S83	-----	618
S23	-----	618
OR. 2087	-----	609
OR. 7574	-----	609
OR. 4716	-----	609
OR. 5428	-----	609
OR. 4724	-----	609
114B	-----	645
OR. 5110	-----	609
OR. 6170	-----	609
S108	-----	618
OR. 4997	-----	609
OR. 6311	-----	609
OR. 8329	-----	609
114K	-----	645
S29	-----	618
NM. T455	-----	609
S93	-----	618
S27	-----	618
OR. 9237	-----	609
NM. T446	-----	609
NM. T197	-----	609
OR. 0198	-----	609
OR. 1905	-----a-----	609
OR. 6106	C-----	609
	His	
OR. 7587	-----	609
OR. 7632	-----	609
OR. 3759	-----t-----	609
OR. 3473	-----t-----	609
1194	-----t-----	645
OR. 7145	-----t-----	609
OR. 3136	-----	609
NM. T529	-----	609
NM. 9999	-----	609
OR. 4541	-----	609
NM. 4094	-----	609

**HPV16 variants
L2**

HPV16R	ATACCAGGGTCTCGCCCAGTGGCACGCCTAGGATTATATAGTCGCACAACACAACAGGTTAAAGTTGTAGAC	4953
HPV16R	IleProGlySerArgProValAlaArgLeuGlyLeuTyrSerArgThrThrGlnGlnValLysValValAsp	
T45	-----	690
T17	-----	690
S83	-----	690
S23	-----a-----	690
OR. 2087	-----a-----	681
OR. 7574	-----a-----	681
OR. 4716	-----a-----	681
OR. 5428	-----a-----	681
OR. 4724	-----a-----	681
114B	-----a-----	717
OR. 5110	-----a-----	681
OR. 6170	-----a-----	681
S108	-----a-----	690
OR. 4997	-----a-----	681
OR. 6311	-----a-----	681
OR. 8329	-----a-----	681
114K	-----a-----	717
S29	-----a-----	690
NM. T455	-----a-----	681
S93	-----a-----	690
S27	-----a-----	690
OR. 9237	-----a-----	681
NM. T446	-----a-----	681
NM. T197	-----a-----	681
OR. 0198	-----a-----	681
OR. 1905	-----t-----a-----	681
OR. 6106	-----t-----a-----	681
OR. 7587	-----t-----a-----	681
OR. 7632	-----t-----a-----	681
OR. 3759	---g-----a-----	681
OR. 3473	---g-----a-----	681
1194	---g-----a-----	717
OR. 7145	---g-----a-----	681
OR. 3136	---g-----a-----g---	681
NM. T529	---g-----a---g---g---	681
NM. 9999	---g-----a---g---g---	681
OR. 4541	---g-----a---g---g---	681
NM. 4094	---g-----a---g---g---	681

**HPV16 variants
L2**

HPV16R	CCTGCTTTTGTAACCACTCCCACTAAACTTATTACATATGATAATCCTGCATATGAAGGTATAGATGTGGAT	5025
HPV16R	ProAlaPheValThrThrProThrLysLeuIleThrTyrAspAsnProAlaTyrGluGlyIleAspValAsp	
T45	-----	762
T17	-----	762
S83	-----	762
S23	-----	762
OR. 2087	-----	753
OR. 7574	-----	753
OR. 4716	-----	753
OR. 5428	-----	753
OR. 4724	-----	753
114B	-----	789
OR. 5110	-----	753
OR. 6170	-----	753
S108	-----	762
OR. 4997	-----	753
OR. 6311	-----	753
OR. 8329	----- -A- Ile	753
114K	-----	789
S29	-----	762
NM. T455	-----	753
S93	-----	762
S27	-----	762
OR. 9237	-----	753
NM. T446	-----	753
NM. T197	-----	753
OR. 0198	-----	753
OR. 1905	-----	753
OR. 6106	-----	753
OR. 7587	-----	753
OR. 7632	-----	753
OR. 3759	-----	753
OR. 3473	-----	753
1194	-----	789
OR. 7145	-----	753
OR. 3136	----- -G- Ala	753
NM. T529	----- -G-	753
NM. 9999	----- -G-	753
OR. 4541	----- -G-	753
NM. 4094	----- -G-	753

HPV16 variants
L2

HPV16R	AATACATTATATTTTTCTAGTAATGATAATAGTATTAATATAGCTCCAGATCCTGACTTTTTGGATATAGTT	5097
HPV16R	AsnThrLeuTyrPheSerSerAsnAspAsnSerIleAsnIleAlaProAspProAspPheLeuAspIleVal	
T45	-----	834
T17	-----	834
S83	-----	834
S23	-----A-----	834
	Asn	
OR. 2087	-----A-----	825
OR. 7574	-----C--A-----	825
	ProAsn	
OR. 4716	-----C--A-----	825
OR. 5428	-----C-----	825
	Pro	
OR. 4724	-----G--C-----	825
	Val Pro	
114B	-----	861
OR. 5110	-----	825
OR. 6170	-----	825
S108	-----	834
OR. 4997	-----	825
OR. 6311	-----	825
OR. 8329	-----	825
114K	-----	861
S29	-----	834
NM. T455	-----g-----	825
S93	-----C-----	834
	Pro	
S27	-----C-----	834
OR. 9237	-----C-----	825
NM. T446	-----C-----	825
NM. T197	-----C-----	825
OR. 0198	-----C-----	825
OR. 1905	-----C-----	825
OR. 6106	-----C-----	825
OR. 7587	-----C-----	825
OR. 7632	-----C-----	825
OR. 3759	-----C-----	825
OR. 3473	-----C-----	825
1194	-----C-----	861
OR. 7145	-----C-----	825
OR. 3136	-----T--C-----t-----	825
	Phe Pro	
NM. T529	-----T--C-----	825
NM. 9999	-----T--C-----	825
OR. 4541	-----T--C-----	825
NM. 4094	-----T--C-----	825

**HPV16 variants
L2**

HPV16R	GCTTTACATAGGCCAGCATTAACTCTAGGCGTACTGGCATTAGGTACAGTAGAATTGGTAATAAACAAACA	5169
HPV16R	AlaLeuHisArgProAlaLeuThrSerArgArgThrGlyIleArgTyrSerArgIleGlyAsnLysGlnThr	
T45	-----	906
T17	-----	906
S83	-----	906
S23	-----	906
OR. 2087	-----	897
OR. 7574	-----	897
OR. 4716	-----	897
OR. 5428	-----	897
OR. 4724	-----	897
114B	-----	933
OR. 5110	-----	897
OR. 6170	-----	897
S108	-----	906
OR. 4997	-----	897
OR. 6311	-----	897
OR. 8329	----- t -----	897
114K	----- a -----	933
S29	-----	906
NM. T455	-----	897
S93	-----	906
S27	-----	906
OR. 9237	-----	897
NM. T446	-----	897
NM. T197	-----	897
OR. 0198	-----	897
OR. 1905	----- a -----	897
OR. 6106	----- a -----	897
OR. 7587	----- a -----	897
OR. 7632	----- a -----	897
OR. 3759	----- a -----	897
OR. 3473	----- a -----	897
1194	----- a -----	933
OR. 7145	----- a -----	897
OR. 3136	----- a ----- C ----- Leu	897
NM. T529	----- a -----	897
NM. 9999	----- a -----	897
OR. 4541	----- a -----	897
NM. 4094	----- a -----	897

**HPV16 variants
L2**

HPV16R	CTACGTACTCGTAGTGAAAAATCTATAGGTGCTAAGGTACATTATTATTATGATTTAAGTACTATTGATCCT	5241
HPV16R	LeuArgThrArgSerGlyLysSerIleGlyAlaLysValHisTyrTyrTyrAspLeuSerThrIleAspPro	
T45	-----	978
T17	-----	978
S83	-----C-----	978
	Phe	
S23	-----T-----	978
OR. 2087	-----C-----	969
OR. 7574	-----C-----	969
OR. 4716	-----C-----	969
OR. 5428	-----C-----	969
OR. 4724	-----C-----	969
114B	-----C-----	1005
OR. 5110	-----C-----	969
OR. 6170	-----C-----	969
S108	-----T-----	978
OR. 4997	-----T-----	969
OR. 6311	-----T-----	969
OR. 8329	-----T-----	969
114K	-----T---c-----	1005
S29	-----C-----	978
NM. T455	-----C-----	969
S93	-----C-----	978
S27	-----g-----	978
OR. 9237	-----g-----	969
NM. T446	-----g-----	969
NM. T197	-----C-----A-----	969
	Phe Asn	
OR. 0198	-----g-----A-----	969
	Asn	
OR. 1905	-----A-----	969
OR. 6106	-----A-----	969
OR. 7587	-----A-----	969
OR. 7632	-----A-----	969
OR. 3759	-----A-----	969
OR. 3473	-----A-----	969
1194	-----A-----	1005
OR. 7145	-----A-----	969
OR. 3136	-----A-----	969
NM. T529	-----A-----	969
NM. 9999	-----A-----	969
OR. 4541	-----G---A-----	969
	Ser Asn	
NM. 4094	-----G---A-----	969

**HPV16 variants
L2**

HPV16R	GCAGAAGAAATAGAATTACAAACTATAACACCTTCTACATATACTACCACTTCACATGCAGCCTCACCTACT	5313
HPV16R	AlaGluGluIleGluLeuGlnThrIleThrProSerThrTyrThrThrThrSerHisAlaAlaSerProThr	
T45	-----	1050
T17	-----	1050
S83	-----	1050
S23	-----	1050
OR. 2087	-----	1041
OR. 7574	-----	1041
OR. 4716	-----	1041
OR. 5428	-----	1041
OR. 4724	-----	1041
114B	-----	1077
OR. 5110	-----	1041
OR. 6170	-----	1041
S108	-----	1050
OR. 4997	-----	1041
OR. 6311	-----	1041
OR. 8329	-----	1041
114K	-----	1077
S29	-----	1050
NM. T455	-----	1041
S93	-----C-----	1050
	His	
S27	-----	1050
OR. 9237	-----	1041
NM. T446	-----	1041
NM. T197	-----	1041
OR. 0198	-----	1041
OR. 1905	-----G-----c--	1041
	Ala	
OR. 6106	-----G-----c--	1041
OR. 7587	-----G-----c--	1041
OR. 7632	-----C-----G-----c--	1041
	Ala	
OR. 3759	-----g-----C-----c--	1041
	Pro	
OR. 3473	-----g-----C-----c--	1041
1194	-----g-----C-----c--	1077
OR. 7145	-----g-----C-----c--	1041
OR. 3136	-----a-----c-----c--	1041
NM. T529	-----a-----c-----a--	1041
NM. 9999	-----a-----c-----a--	1041
OR. 4541	-----a-----c-----a--	1041
NM. 4094	-----a-----c-----a--	1041

HPV16 variants
L2

HPV16R	TCTATTAATAATGGATTATATGATATTTATGCAGATGACTTTATTACAGATACTTCTACAACCCCGGTACCA	5385
HPV16R	SerIleAsnAsnGlyLeuTyrAspIleTyrAlaAspAspPheIleThrAspThrSerThrThrProValPro	
T45	-----	1122
T17	-----	1122
S83	-----	1122
S23	-----T-----	1122
	Phe	
OR. 2087	-----T-----	1113
OR. 7574	-----T-----	1113
OR. 4716	-----T-----	1113
OR. 5428	-----	1113
OR. 4724	-----	1113
114B	-----	1149
OR. 5110	-----	1113
OR. 6170	-----	1113
S108	-----	1122
OR. 4997	-----	1113
OR. 6311	-----	1113
OR. 8329	-----	1113
114K	-----	1149
S29	-----	1122
NM. T455	-----c-----	1113
S93	-----	1122
S27	-----A-----	1122
	Glu	
OR. 9237	-----	1113
NM. T446	-----	1113
NM. T197	-----	1113
OR. 0198	-----	1113
OR. 1905	-----	1113
OR. 6106	-----a-----	1113
OR. 7587	-----a-----	1113
OR. 7632	-----a-----	1113
OR. 3759	-----T-----a-----	1113
	Phe	
OR. 3473	-----T-----a-----	1113
1194	-----T-----a-----	1149
OR. 7145	-----T-----a-----	1113
OR. 3136	-----GT-----a-----	1113
	Val	
NM. T529	-----GT-----a-----	1113
NM. 9999	-----GT-----a-----	1113
OR. 4541	-----GT-----a-----	1113
NM. 4094	-----GT-----a-----	1113

**HPV16 variants
L2**

HPV16R	TCTGTACCCTCTACATCTTTATCAGGTTATATTCCTGCAAATACAACAATTCCTTTTGGTGGTGCATACAAT	5457
HPV16R	SerValProSerThrSerLeuSerGlyTyrIleProAlaAsnThrThrIleProPheGlyGlyAlaTyrAsn	
T45	-----	1194
T17	-----	1194
S83	-----	1194
S23	-----	1194
OR. 2087	-----	1185
OR. 7574	-----	1185
OR. 4716	-----	1185
OR. 5428	-----	1185
OR. 4724	-----	1185
114B	-----C-----	1221
	His	
OR. 5110	-----	1185
OR. 6170	-----	1185
S108	-----	1194
OR. 4997	-----	1185
OR. 6311	-----	1185
OR. 8329	-----	1185
114K	-----	1221
S29	-----	1194
NM. T455	-----	1185
S93	-----	1194
S27	-----	1194
OR. 9237	-T-----	1185
	Phe	
NM. T446	-----	1185
NM. T197	-----	1185
OR. 0198	-----	1185
OR. 1905	--A-----c-----	1185
	Ile	
OR. 6106	--A-----c-----	1185
OR. 7587	--A-----c-----	1185
OR. 7632	--A-----c-----	1185
OR. 3759	--A-----c-----	1185
OR. 3473	--A-----c-----	1185
1194	--A-----c-----	1221
OR. 7145	--A-----c-----	1185
OR. 3136	G-A-----c-----	1185
	AlaIle	
NM. T529	G-A-----c-----	1185
NM. 9999	G-A-----c-----	1185
OR. 4541	G-A-----c-----	1185
NM. 4094	G-A-----c-----	1185

**HPV16 variants
L2**

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                                L1 orf start ->
HPV16R      ATTCCTTTAGTATCAGGTCCTGATATACCCATTAATATAACTGACCAAGCTCCTTCATTAATTCCTATAGTT      5529
HPV16R      IleProLeuValSerGlyProAspIleProIleAsnIleThrAspGlnAlaProSerLeuIleProIleVal
HPV16R      $$$Ph
T45         -----
T17         -----
S83         -----
S23         -----C-----
                                Leu
OR. 2087    -----C-----
OR. 7574    -----C-----
OR. 4716    -----C-----
OR. 5428    -----C-----
OR. 4724    -----
114B       -----
OR. 5110    -----
OR. 6170    -----
S108       -----
OR. 4997    -----
OR. 6311    -----
OR. 8329    -----
114K       -----
S29        -----
NM. T455    -----
S93        -----
S27        -----
OR. 9237    -----
NM. T446    -----
NM. T197    -----
OR. 0198    -----
OR. 1905    -----C-----A-----
                                Thr      Thr
OR. 6106    -----C-----A-----
OR. 7587    -----C-----A-----
OR. 7632    -----C-----A-----
OR. 3759    -----t-----C-----A-----
OR. 3473    -----t-----C-----A-----
1194       -----t-----C-----A-----
OR. 7145    -----t-----CC-----A-----
OR. 3136    -----t-----C-----A-----
NM. T529    -----a-----t-----C-----A-----
NM. 9999    -----a-----t-----C-----A-----
OR. 4541    -----a-----t-----C-----A-----
NM. 4094    -----a-----t-----C-----A-----
                                Thr      Asn      Thr

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**HPV16 variants
L2**

	first "ATG" of L1 orf ->	
HPV16R	CCAGGGTCTCCACAATATACAATTATGCTGATGCAGGTGACTTTTATTTACATCCTAGTTATTACATGTTA	5601
HPV16R	ProGlySerProGlnTyrThrIleIleAlaAspAlaGlyAspPheTyrLeuHisProSerTyrTyrMetLeu	
HPV16R	eGlnGlyLeuHisAsnIleGlnLeuLeuLeuMetGlnValThrPheIleTyrIleLeuValIleThrCysTy	
T45	-----	1338
T17	-----	1338
S83	-----	1338
S23	-----	1338
OR.2087	-----	1329
OR.7574	-----	1329
OR.4716	-----	1329
OR.5428	-----	1329
OR.4724	-----	1329
114B	-----	1365
OR.5110	-----	1329
OR.6170	-----	1329
S108	-----	1338
OR.4997	-----	1329
OR.6311	-----	1329
OR.8329	-----	1329
114K	-----	1365
S29	-----	1338
NM.T455	-----	1329
S93	-----	1338
S27	-----	1338
OR.9237	-----	1329
NM.T446	-----	1329
NM.T197	-----	1329
OR.0198	-----	1329
OR.1905	-----G-----	1329
	Gly	
OR.6106	-----G-----	1329
OR.7587	-----G-----	1329
OR.7632	-----G-----	1329
OR.3759	-----G-----	1329
OR.3473	-----G-----	1329
1194	-----G-----	1365
OR.7145	-----G-----	1329
OR.3136	--g-----G-----	1329
NM.T529	-----G-----	1329
NM.9999	-----G-----	1329
OR.4541	-----G-----	1329
NM.4094	-----G-----	1329

**HPV16 variants
L2, L1**

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                                \ / 3' sj
                                L1 cds ->                                <- L2 end
HPV16R      CGAAAACGACGTAAACGTTTACCATATTTTTTTTCAGATGTCTCTTTGGCTGCCTAGT 5659
HPV16R      ArgLysArgArgLysArgLeuProTyrPhePheSerAspValSerLeuAlaAla$$$
HPV16R      rGluAsnAspValAsnValTyrHisIlePhePheGlnMetSerLeuTrpLeuProSer
T45         ----- 1369
T17         ----- 1369
S83         ----- 1369
S23         ----- 1369
OR. 2087    ----- 1386
OR. 7574    ----- 1386
OR. 4716    ----- 1386
OR. 5428    ----- 1386
OR. 4724    ----- 1386
114B       ----- 1422
OR. 5110    ----- 1386
OR. 6170    ----- 1386
S108       ----- 1369
OR. 4997    ----- 1386
OR. 6311    ----- 1386
OR. 8329    ----- 1386
114K       ----- 1422
S29         ----- 1369
NM. T455    ----- 1386
S93         ----- 1369
S27         ----- 1369
OR. 9237    ----- 1386
NM. T446    ----- 1386
NM. T197    ----- 1386
OR. 0198    ----- 1386
OR. 1905    ----- 1386
OR. 6106    ----- 1386
OR. 7587    ----- 1386
OR. 7632    ----- 1386
OR. 3759    ----- 1386
OR. 3473    ----- 1386
1194       ----- 1422
OR. 7145    ----- 1386
OR. 3136    ----- 1386
NM. T529    ----- 1386
NM. 9999    ----- 1386
OR. 4541    ----- 1386
NM. 4094    ----- 1386

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**HPV16 variants
L1**

HPV16R	GAGGCCACTGTCTACTTGCCTCCTGTCCAGTATCTAAGGTTGTAAGCACGGATGAATATGTTGCACGCACA	5731
HPV16R	GluAlaThrValTyrLeuProProValProValSerLysValValSerThrAspGluTyrValAlaArgThr	
114K	-----	93
NM.T455	-----	66
S23	-----	69
OR.5110	-----	66
OR.6170	-----	66
S29	-----	69
S83	-----	69
OR.4724	-----	66
OR.4997	-----	66
OR.8329	-----	66
S27	-----	69
114B	-----	93
OR.6311	-----	66
NM.T446	-----	66
OR.2087	-----	66
OR.5428	-----	66
OR.4716	-----	66
S93	-----	69
NM.T197	-----	66
OR.9237	-----	66
OR.0198	-----	66
OR.7574	-----	66
S99	-----	69
T45	-----	69
T17	-----	69
OR.1905	-----a-----	66
OR.6106	-----a-----	66
OR.7632	-----a-----	66
OR.7587	-----a-----	66
NM.4094	-----a-----	66
NM.9999	-----a-----	66
OR.4541	-----a-----	66
NM.T529	-----a-----	66
OR.3136	-----a-----	66
OR.3759	-----a-----	66
OR.3473	-----a-----	66
OR.7145	-----a-----	66
1194	-----a-----	93

**HPV16 variants
L1**

HPV16R	AACATATATTATCATGCAGGAACATCCAGACTACTTGCAGTTGGACATCCCTATTTTCCTATTAACAAAACCT	5803
HPV16R	AsnIleTyrTyrHisAlaGlyThrSerArgLeuLeuAlaValGlyHisProTyrPheProIleLysLysPro	
114K	-----	165
NM.T455	-----	138
S23	-----	141
OR.5110	-----	138
OR.6170	-----	138
S29	-----	141
S83	-----	141
OR.4724	-----	138
OR.4997	-----	138
OR.8329	-----	138
S27	-----	141
114B	-----	165
OR.6311	-----	138
NM.T446	-----	138
OR.2087	-----	138
OR.5428	-----	138
OR.4716	-----	138
S93	-----	141
NM.T197	-----	138
OR.9237	-----	138
OR.0198	-----	138
OR.7574	-----	138
S99	-----	141
T45	-----	141
T17	-----	141
OR.1905	-----	138
OR.6106	-----	138
OR.7632	-----	138
OR.7587	-----	138
NM.4094	-----	138
NM.9999	-----	138
OR.4541	-----	138
NM.T529	-----	138
OR.3136	-----	138
OR.3759	-----	138
OR.3473	-----	138
OR.7145	-----	138
1194	-----	165

**HPV16 variants
L1**

HPV16R	AACAATAACAAAATATTAGTTCCTAAAGTATCAGGATTACAATACAGGGTATTTAGAATACATTTACCTGAC	5875
HPV16R	AsnAsnAsnLysIleLeuValProLysValSerGlyLeuGlnTyrArgValPheArgIleHisLeuProAsp	
114K	-----	237
NM.T455	-----	210
S23	-----	213
OR.5110	-----	210
OR.6170	-----	210
S29	-----	213
S83	-----	213
OR.4724	-----	210
OR.4997	-----	210
OR.8329	-----	210
S27	-----	213
114B	-----	237
OR.6311	-----	210
NM.T446	-----	210
OR.2087	-----	210
OR.5428	-----	210
OR.4716	-----	210
S93	-----	213
NM.T197	-----	210
OR.9237	-----	210
OR.0198	-----	210
OR.7574	-----	210
S99	-----	213
T45	-----	213
T17	-----	213
OR.1905	-----T-----	210
	Tyr	
OR.6106	-----T-----	210
OR.7632	-----T-----	210
OR.7587	-----T-----	210
NM.4094	-----T-----	210
NM.9999	-----T-----	210
OR.4541	-----T-----	210
NM.T529	-----T-----	210
OR.3136	-----T-----	210
OR.3759	-----T-----	210
OR.3473	-----T-----	210
OR.7145	-----T-----	210
1194	-----T-----	237

HPV16 variants
L1

HPV16R	CCCAATAAGTTTGGTTTTCTGACACCTCATTTTATAATCCAGATACACAGCGGCTGGTTTGGGCCTGTGTA	5947
HPV16R	ProAsnLysPheGlyPheProAspThrSerPheTyrAsnProAspThrGlnArgLeuValTrpAlaCysVal	
114K	-----	309
NM.T455	-----	282
S23	-----	285
OR.5110	-----	282
OR.6170	-----	282
S29	-----	285
S83	-----	285
OR.4724	-----	282
OR.4997	-----	282
OR.8329	-----	282
S27	-----	285
114B	-----	309
OR.6311	-----	282
NM.T446	-----	282
OR.2087	-----	282
OR.5428	-----	282
OR.4716	-----	282
S93	-----	285
NM.T197	-----	282
OR.9237	-----	282
OR.0198	-----	282
OR.7574	-----	282
S99	-----	285
T45	-----	285
T17	-----	285
	G-----	
	Asp-----	
OR.1905	-----C-----	282
OR.6106	-----C-----	282
OR.7632	-----C-----	282
OR.7587	-----C-----	282
NM.4094	-----C-----	282
NM.9999	-----C-----	282
OR.4541	-----C-----	282
NM.T529	-----C-----	282
OR.3136	-----C-----	282
OR.3759	-----C-----	282
OR.3473	-----C-----	282
OR.7145	-----C-----	282
1194	-----C-----	309

**HPV16 variants
L1**

HPV16R	GGTGTTGAGGTAGGTCGTGGTCAGCCATTAGGTGTGGGCATTAGTGGCCATCCTTTATTAATAAATAATTGGAT	6019
HPV16R	GlyValGluValGlyArgGlyGlnProLeuGlyValGlyIleSerGlyHisProLeuLeuAsnLysLeuAsp	
114K	-----	381
NM.T455	-----	354
S23	-----	357
OR.5110	-----	354
OR.6170	-----	354
S29	-----	357
S83	-----	357
OR.4724	-----	354
OR.4997	-----	354
OR.8329	-----	354
S27	-----	357
114B	-----	381
OR.6311	-----c-----	354
NM.T446	-----	354
OR.2087	-----	354
OR.5428	-----	354
OR.4716	-----	354
S93	-----	357
NM.T197	-----	354
OR.9237	-----	354
OR.0198	-----	354
OR.7574	-----	354
S99	-----	357
T45	-----	357
T17	-----	357
OR.1905	-----	354
OR.6106	-----	354
OR.7632	-----	354
OR.7587	-----	354
NM.4094	-----	354
NM.9999	-----	354
OR.4541	-----	354
NM.T529	-----	354
OR.3136	-----	354
OR.3759	-----	354
OR.3473	-----	354
OR.7145	-----	354
1194	-----	381

HPV16 variants
L1

HPV16R	GACACAGAAAATGCTAGTGCTTATGCAGCAAATGCAGGTGTGGATAATAGAGAATGTATATCTATGGATTAC	6091
HPV16R	AspThrGluAsnAlaSerAlaTyrAlaAlaAsnAlaGlyValAspAsnArgGluCysIleSerMetAspTyr	
114K	-----	453
NM.T455	-----	426
S23	-----	429
OR.5110	-----	426
OR.6170	-----	426
S29	-----	429
S83	-----	429
OR.4724	-----	426
OR.4997	-----	426
OR.8329	-----	426
S27	-----	429
114B	-----	453
OR.6311	-----	426
NM.T446	-----	426
OR.2087	-----	426
OR.5428	-----	426
OR.4716	-----	426
S93	-----	429
NM.T197	-----	426
OR.9237	-----	426
OR.0198	-----	426
OR.7574	-----	426
S99	-----	429
T45	-----	429
T17	-----	429
OR.1905	-----	426
OR.6106	-----g-----	426
OR.7632	-----	426
OR.7587	-----	426
NM.4094	-----	426
NM.9999	-----	426
OR.4541	-----	426
NM.T529	-----	426
OR.3136	-----	426
OR.3759	-----	426
OR.3473	-----	426
OR.7145	-----	426
1194	-----	453

**HPV16 variants
L1**

HPV16R	AAACAAACACAATTGTGTTTAATTGGTTGCAAACCACCTATAGGGGAACACTGGGGCAAAGGATCCCCATGT	6163
HPV16R	LysGlnThrGlnLeuCysLeuIleGlyCysLysProProIleGlyGluHisTrpGlyLysGlySerProCys	
114K	-----C-----	525
NM.T455	----- Leu	498
S23	-----	501
OR.5110	-----	498
OR.6170	-----	498
S29	-----	501
S83	-----	501
OR.4724	-----	498
OR.4997	-----	498
OR.8329	-----	498
S27	-----	501
114B	-----	525
OR.6311	-----	498
NM.T446	-----	498
OR.2087	-----	498
OR.5428	-----	498
OR.4716	-----	498
S93	-----	501
NM.T197	-----	498
OR.9237	-----	498
OR.0198	-----	498
OR.7574	-----	498
S99	-----c-----	501
T45	-----	501
T17	-----	501
OR.1905	-----	498
OR.6106	-----	498
OR.7632	-----	498
OR.7587	-----	498
NM.4094	-----	498
NM.9999	-----	498
OR.4541	-----	498
NM.T529	-----	498
OR.3136	-----	498
OR.3759	-----	498
OR.3473	-----	498
OR.7145	-----	498
1194	-----	525

HPV16 variants
L1

	degenerate E2 bind -> <-	
HPV16R	ACCAATGTTGCAGTAAATCCAGGTGATTGTCCACCATTAGAGTTAATAACACAGTTATTCAGGATGGTGAT	6235
HPV16R	ThrAsnValAlaValAsnProGlyAspCysProProLeuGluLeuIleAsnThrValIleGlnAspGlyAsp	
114K	-----	597
NM.T455	-----	570
S23	-----C-----	573
	Thr	
OR.5110	-----	570
OR.6170	-----	570
S29	-----	573
S83	-----	573
OR.4724	-----	570
OR.4997	-----	570
OR.8329	-----	570
S27	-----	573
114B	-----A-----	597
	Ile	
OR.6311	-----	570
NM.T446	-----	570
OR.2087	-----	570
OR.5428	-----	570
OR.4716	-----	570
S93	-----	573
NM.T197	-----C-----	570
	Leu	
OR.9237	-----	570
OR.0198	-----	570
OR.7574	-----C-----	570
	Thr	
S99	-----	573
T45	-----	573
T17	-----C-----	573
OR.1905	-A-----	570
	Asn	
OR.6106	-A-----	570
OR.7632	-A-----	570
OR.7587	-A-----	570
NM.4094	-A-----C-----	570
	Asn Thr	
NM.9999	-A-----C-----	570
OR.4541	-A-----C-----	570
NM.T529	-A-----C-----	570
OR.3136	-A-----	570
	Asn	
OR.3759	-A-----	570
OR.3473	-A-----C-----	570
	Asn Thr	
OR.7145	-A-----C-----	570
1194	-A-----C-----	597

**HPV16 variants
L1**

	V wild-type has 'G', original clone had 'C'	
HPV16R	ATGGTTGATACTGGCTTTGGTGCTATGGACTTTACTACATTACAGGCTAACAAAAGTGAAGTTCCACTGGAT	6307
HPV16R	MetValAspThrGlyPheGlyAlaMetAspPheThrThrLeuGlnAlaAsnLysSerGluValProLeuAsp	
114K	-----	669
NM.T455	-----	642
S23	-----	645
OR.5110	-----	642
OR.6170	-----	642
S29	-----	645
S83	-----	645
OR.4724	-----	642
OR.4997	-----	642
OR.8329	-----	642
S27	-----	645
114B	-----	669
OR.6311	-----	642
NM.T446	-----	642
OR.2087	-----	642
OR.5428	-----	642
OR.4716	-----	642
S93	-----	645
NM.T197	-----	642
OR.9237	-----	642
OR.0198	-----	642
OR.7574	-----	642
S99	-----	645
T45	-----	645
T17	-----G-	645
	Gly	
OR.1905	-----C-----	642
OR.6106	-----C-----	642
OR.7632	-----C-----	642
OR.7587	-----C-----	642
NM.4094	-----C-----	642
NM.9999	-----C-----	642
OR.4541	-----C-----	642
NM.T529	-----C-----	642
OR.3136	-----C-----	642
OR.3759	-----C-----	642
OR.3473	-----C-----	642
OR.7145	-----C-----	642
1194	-----C-----	669
84	-----	38

HPV16 variants
L1

HPV16R	ATTTGTACATCTATTTGCAAATATCCAGATTATATTAAAAATGGTGTGTCAGAACCATATGGCGACAGCTTATTT	6379
HPV16R	IleCysThrSerIleCysLysTyrProAspTyrIleLysMetValSerGluProTyrGlyAspSerLeuPhe	
ALASKA-C51	-----	32
MICHIGAN-B8	-----	32
PANAMA-156	-----	32
PANAMA-206	-----	32
PANAMA-B4	-----	32
PANAMA-D6	-----	32
BT6	-----	9
BT11	-----	9
DT24	-----	9
114K	-----	741
NM.T455	-----	714
S23	-----	717
OR.5110	-----	714
OR.6170	-----	714
S29	-----	717
S83	-----	717
OR.4724	-----	714
OR.4997	-----	714
OR.8329	-----	714
S27	-----	717
114B	-----	741
OR.6311	-----	714
NM.T446	-----	714
OR.2087	-----	714
OR.5428	-----	714
OR.4716	-----	714
S93	-----	717
NM.T197	-----	714
OR.9237	-----	714
OR.0198	-----	714
OR.7574	-----	714
S99	-----	717
T45	-----	717
ALASKA-C32	-----	32
CASKI	-----	32
PANAMA-C20	-----	32
PANAMA-F30	-----	32
BT23	-----	9
DC141	-----	9
DC207	-----	9
DC269	-----	9
BT15	-----	9
BT12	-----	9
BT10	-----	9
BT22	-----	9
ALABAMA-B24	-----	32
MISSOURI-B11	-----	32
PANAMA-349	-----	32
SIHA	-----	32
T17	-----	717
BT7	-----	9
BT20	-----	9
GEORGIA-B9	-----	32
PANAMA-200	-----	32
ALABAMA-B23	-----	32
OR.1905	-----g-----	714
OR.6106	-----g-----	714
OR.7632	-----g-----	714
OR.7587	-----g-----	714
NM.4094	-----	714
NM.9999	-----	714
OR.4541	-----	714
NM.T529	-----	714
OR.3136	-----g-----	714
OR.3759	-----g-----	714
OR.3473	-----g-----	714
OR.7145	-----g-----	714
1194	-----g-----	741
84	-----g-----	110

**HPV16 variants
L1**

HPV16R	TTTTATTACGAAGGGAACAAATGTTTGTAGACATTATTAAATAGGGCTGGTACTGTTGGTGAAAATGTA	6451
HPV16R	PheTyrLeuArgArgGluGlnMetPheValArgHisLeuPheAsnArgAlaGlyThrValGlyGluAsnVal	
ALASKA-C51	-----	104
MICHIGAN-B8	-----	104
PANAMA-156	-----	104
PANAMA-206	-----	104
PANAMA-B4	-----	104
PANAMA-D6	-----	104
BT6	-----	81
BT11	-----	81
DT24	-----	81
114K	-----	813
NM.T455	-----	786
S23	-----	789
OR.5110	-----	786
OR.6170	-----	786
S29	-----	789
S83	-----	789
OR.4724	-----G-----	786
	Ala	
OR.4997	-----G-----	786
OR.8329	-----G-----	786
S27	-----G-----	789
114B	-----G-----	813
OR.6311	-----G-----	786
NM.T446	-----G-----	786
OR.2087	-----G-----	786
OR.5428	-----G-----	786
OR.4716	-----G-----	786
S93	-----g-----G-----	789
NM.T197	-----G-----	786
OR.9237	-----G-----	786
OR.0198	-----G-----	786
OR.7574	-----G-----	786
S99	-----G-----	789
T45	-----g-----G-----	789
ALASKA-C32	-----G-----	104
CASKI	-----G-----	104
PANAMA-C20	-----G-----	104
PANAMA-F30	-----G-----	104
BT23	-----G-----	81
DC141	-----G-----	81
DC207	-----G-----	81
DC269	-----G-----	81
BT15	-----G-----	81
BT12	-----G-----	81
BT10	-----G-----	81
BT22	-----G-----	81
ALABAMA-B24	-----G-----	104
MISSOURI-B11	-----G-----	104
PANAMA-349	-----G-----	104
SIHA	-----G-----	104
T17	-----	789
BT7	-----G-----	81
BT20	-----G-----C-----	81
	Ala His	
GEORGIA-B9	-----G-----	104
	Ala	
PANAMA-200	-----G-----	104
ALABAMA-B23	-----G-----	104
OR.1905	-----G-----	786
OR.6106	-----G-----	786
OR.7632	-----G-----	786
OR.7587	-----G-----	786
NM.4094	-----G-----	786
NM.9999	-----G-----	786
OR.4541	-----G-----	786
NM.T529	-----G-----	786
OR.3136	-----G-----	786
OR.3759	-----G-----	786
OR.3473	-----G-----	786
OR.7145	-----G-----	786
1194	-----G-----	813
84	-----G-----	182

HPV16 variants
L1

HPV16R	CCAGACGATTTATACATTAAGGCTCTGGGTCTACTGCAAATTTAGCCAGTTCAAATTATTTTCCTACACCT	6523
HPV16R	ProAspAspLeuTyrIleLysGlySerGlySerThrAlaAsnLeuAlaSerSerAsnTyrPheProThrPro	
ALASKA-C51	-----	176
MICHIGAN-B8	-----	176
PANAMA-156	-----	176
PANAMA-206	-----	176
PANAMA-B4	-----	176
PANAMA-D6	-----	176
BT6	-----	153
BT11	-----	153
DT24	-----	153
114K	-----	885
NM.T455	-----	858
S23	-----	861
OR.5110	-----	858
OR.6170	-----	858
S29	-----	861
S83	-----	861
OR.4724	-----	858
OR.4997	-----	858
OR.8329	-----	858
S27	-----	861
114B	-----	885
OR.6311	-----	858
NM.T446	-----	858
OR.2087	-----	858
OR.5428	-----	858
OR.4716	-----	858
S93	-----	861
NM.T197	-----	858
OR.9237	-----	858
OR.0198	-----	858
OR.7574	-----	858
S99	-----	861
T45	-----	861
	-G-	
	Gly	
ALASKA-C32	-----	176
CASKI	-----	176
PANAMA-C20	-----	176
PANAMA-F30	-----	176
BT23	-----	153
DC141	-----	153
DC207	-----	153
DC269	-----	153
BT15	-----	153
BT12	-----	153
BT10	-----	153
BT22	-----	153
ALABAMA-B24	-----	176
MISSOURI-B11	-----	176
PANAMA-349	-----	176
SIHA	-----	176
T17	-----	861
BT7	-----	153
	-C-	
	Pro	
BT20	-----	153
GEORGIA-B9	-----	176
PANAMA-200	-----	176
ALABAMA-B23	-----	176
OR.1905	-----	858
OR.6106	-----	858
OR.7632	-----	858
OR.7587	-----	858
NM.4094	-----	858
NM.9999	-----	858
OR.4541	-----	858
NM.T529	-----	858
OR.3136	-----	858
OR.3759	-----	858
OR.3473	-----	858
OR.7145	-----	858
1194	-----	885
84	-----	254

**HPV16 variants
L1**

	degenerate E2 bind ->	<-	
HPV16R	AGTGGTCTATGGTTACCTCTGATGCCCAAATATTCAATAAACCTTATTGGTTACAACGAGCACAGGGCCAC		6595
HPV16R	SerGlySerMetValThrSerAspAlaGlnIlePheAsnLysProTyrTrpLeuGlnArgAlaGlnGlyHis		
ALASKA-C51	-----		248
MICHIGAN-B8	-----		248
PANAMA-156	-----		248
PANAMA-206	-----		248
PANAMA-B4	-----		248
PANAMA-D6	-----		248
BT6	-----		207
BT11	-----		207
DT24	-----		207
114K	-----		957
NM.T455	-----		930
S23	-----		933
OR.5110	-----		930
OR.6170	-----		930
S29	-----		933
S83	-----		933
OR.4724	-----		930
OR.4997	-----		930
OR.8329	-----		930
S27	-----		933
114B	-----		957
OR.6311	-----		930
NM.T446	-----		930
OR.2087	-----		930
OR.5428	-----		930
OR.4716	-----		930
S93	-----		933
NM.T197	-----		930
OR.9237	-----		930
OR.0198	-----		930
OR.7574	-----		930
S99	-----		933
T45	-----		933
ALASKA-C32	-----		248
CASKI	-----		248
PANAMA-C20	-----		248
PANAMA-F30	-----		248
BT23	-----		207
DC141	-----		207
DC207	-----		207
DC269	-----		207
BT15	-----		207
BT12	-----		207
BT10	-----		207
BT22	-----		207
ALABAMA-B24	-----c-----		248
MISSOURI-B11	-----t-----		248
PANAMA-349	-----t-----		248
SIHA	-----		248
T17	-----		933
BT7	-----		207
BT20	-----		207
GEORGIA-B9	-----t-----		248
PANAMA-200	-----t-----		248
ALABAMA-B23	-----t-----		248
OR.1905	-----t-----a-----		930
OR.6106	-----t-----a-----g-----		930
OR.7632	-----t-----a-----g-----		930
OR.7587	-----t-----a-----g-----		930
NM.4094	-----t-----		930
NM.9999	-----t-----		930
OR.4541	-----t-----		930
NM.T529	-----a-----t-----		930
OR.3136	-----t-----		930
OR.3759	-----t-----		930
OR.3473	-----t-----		930
OR.7145	-----t-----		930
1194	-----t-----		957
84	-----t-----		326

HPV16 variants
L1

HPV16R	AATAATGGCATTGTGGGGTAACCAACTATTGTACTGTGTTGATACTACACGCAGTACAAATATGTCA	6667
HPV16R	AsnAsnGlyIleCysTrpGlyAsnGlnLeuPheValThrValValAspThrThrArgSerThrAsnMetSer	
ALASKA-C51	-----	268
MICHIGAN-B8	-----	268
PANAMA-156	-----	268
PANAMA-206	-----	268
PANAMA-B4	-----	268
PANAMA-D6	-----	268
114K	-----	1029
NM.T455	-----	1002
S23	-----	1005
OR. 5110	-----	1002
OR. 6170	-----	1002
S29	-----	1005
S83	-----	1005
OR. 4724	-----	1002
OR. 4997	-----	1002
OR. 8329	-----	1002
S27	-----	1005
114B	-----	1029
OR. 6311	-----	1002
NM.T446	-----	1002
OR. 2087	-----	1002
OR. 5428	-----	1002
OR. 4716	-----	1002
S93	-----	1005
NM.T197	-----	1002
OR. 9237	-----	1002
OR. 0198	-----	1002
OR. 7574	-----	1002
S99	-----	1005
T45	-----	1005
ALASKA-C32	-----	268
CASKI	-----	268
PANAMA-C20	-----	268
PANAMA-F30	-----	268
ALABAMA-B24	-----	268
MISSOURI-B11	-----	268
PANAMA-349	-----	268
SIHA	-----	268
T17	-----G----- Ser	1005
GEORGIA-B9	-----	268
PANAMA-200	-----	268
ALABAMA-B23	-----	268
OR. 1905	-----	1002
OR. 6106	-----	1002
OR. 7632	-----	1002
OR. 7587	-----	1002
NM. 4094	-----	1002
NM. 9999	-----	1002
OR. 4541	-----	1002
NM.T529	-----	1002
OR. 3136	-----	1002
OR. 3759	-----	1002
OR. 3473	-----	1002
OR. 7145	-----	1002
1194	-----	1029
84	-----	360
1268	-----	10

**HPV16 variants
L1**

	signal -> <-	
HPV16R	TTATGTGCTGCCATATCTACTTCAGAAACTACATATAAAAAATACTAACTTTAAGGAGTACCTACGACATGGG	6739
HPV16R	LeuCysAlaAlaIleSerThrSerGluThrThrTyrLysAsnThrAsnPheLysGluTyrLeuArgHisGly	
114K	-----	1101
NM.T455	-----	1074
S23	-----	1077
OR.5110	-----	1074
OR.6170	-----	1074
S29	-----	1077
S83	-----	1077
OR.4724	-----	1074
OR.4997	-----	1074
OR.8329	-----	1074
S27	-----	1077
114B	-----	1101
OR.6311	-----	1074
NM.T446	-----	1074
OR.2087	-----	1074
OR.5428	-----	1074
OR.4716	-----	1074
S93	-----	1077
NM.T197	-----	1074
OR.9237	-----	1074
OR.0198	-----	1074
OR.7574	-----	1074
S99	-----	1077
T45	-----	1077
T17	-----	1077
OR.1905	-----a-----	1074
OR.6106	-----a-----	1074
OR.7632	-----a-----	1074
OR.7587	-----a-----	1074
NM.4094	-----C-----a-----	1074
	Pro	
NM.9999	-----C-----a-----	1074
OR.4541	-----C-----a-----	1074
NM.T529	-----C-----a-----	1074
OR.3136	-----C-----a-----	1074
OR.3759	-----C-----a-----	1074
OR.3473	-----C-----a-----	1074
OR.7145	-----C-----a-----	1074
1194	-----C-----a-----	1101
84	-----C-----a-----	432
1268	-----C-----a-----	82

HPV16 variants
L1

HPV16R	GAGGAATATGATTTACAGTTTATTTTTCAACTGTGCAAAATAACCTTAACTGCAGACGTTATGACATACATA	6811
HPV16R	GluGluTyrAspLeuGlnPheIlePheGlnLeuCysLysIleThrLeuThrAlaAspValMetThrTyrIle	
114K	-----	1173
NM.T455	-----	1146
S23	-----	1149
OR.5110	-----	1146
OR.6170	-----	1146
S29	-----	1149
S83	-----	1149
OR.4724	-----	1146
OR.4997	-----	1146
OR.8329	-----	1146
S27	-----	1149
114B	-----	1173
OR.6311	-----	1146
NM.T446	-----	1146
OR.2087	-----	1146
OR.5428	-----	1146
OR.4716	-----	1146
S93	-----	1149
NM.T197	-----	1146
OR.9237	-----	1146
OR.0198	-----	1146
OR.7574	-----	1146
S99	-----	1149
T45	-----	1149
T17	-----	1149
OR.1905	-----	1146
OR.6106	-----	1146
OR.7632	-----	1146
OR.7587	-----	1146
NM.4094	-----T-----	1146
	Ser	
NM.9999	-----T-----	1146
OR.4541	-----T-----	1146
NM.T529	-----T-----	1146
OR.3136	-----	1146
OR.3759	-----	1146
OR.3473	-----	1146
OR.7145	-----	1146
1194	-----	1173
84	-----	504
1268	-----	154

**HPV16 variants
L1**

HPV16R	CATTCTATGAATCCACTATTTTGGAGGACTGGAATTTGGTCTACAACCTCCCCAGGAGGCACACTAGAA	6883
HPV16R	HisSerMetAsnSerThrIleLeuGluAspTrpAsnPheGlyLeuGlnProProProGlyGlyThrLeuGlu	
114K	-----	1245
NM.T455	-----	1218
S23	-----	1221
OR.5110	-----	1218
OR.6170	-----	1218
S29	-----	1221
S83	-----	1221
OR.4724	-----	1218
OR.4997	-----	1218
OR.8329	-----	1218
S27	-----	1221
114B	-----	1245
OR.6311	-----	1218
NM.T446	-----c-----	1218
OR.2087	-----	1218
OR.5428	-----	1218
OR.4716	-----	1218
S93	-----	1221
NM.T197	-----c-----	1218
OR.9237	-----c-----	1218
OR.0198	-----c-----	1218
OR.7574	-----	1218
S99	-----c-----	1221
T45	-----	1221
T17	-----	1221
OR.1905	-----t-----	1218
OR.6106	-----t-----	1218
OR.7632	-----t-----	1218
OR.7587	-----t-----	1218
NM.4094	-----t-----t-----	1218
NM.9999	-----t-----t-----	1218
OR.4541	-----t-----t-----	1218
NM.T529	-----t-----t-----	1218
OR.3136	-----t-----t-----	1218
OR.3759	-----t-----t-----	1218
OR.3473	-----t-----t-----	1218
OR.7145	-----t-----t-----	1218
1194	-----t-----t-----	1245
84	-----t-----t-----	576
1268	-----t-----t-----	226

**HPV16 variants
L1**

HPV16R	GATACTTATAGGTTTGTAAACATCCCAGGCAATTGCTTGTCAAAAACATACACCTCCAGCACCTAAAGAAGAT	6955
HPV16R	AspThrTyrArgPheValThrSerGlnAlaIleAlaCysGlnLysHisThrProProAlaProLysGluAsp	
114K	-----	1317
NM.T455	-----	1290
S23	-----	1293
OR.5110	-----	1290
OR.6170	-----	1290
S29	-----	1293
S83	-----	1293
OR.4724	-----	1290
OR.4997	-----	1290
OR.8329	-----	1290
S27	-----	1293
114B	-----	1317
OR.6311	-----	1290
NM.T446	-----	1290
OR.2087	-----	1290
OR.5428	-----	1290
OR.4716	-----	1290
S93	-----	1293
NM.T197	-----	1290
OR.9237	-----	1290
OR.0198	-----	1290
OR.7574	-----	1290
S99	-----	1293
T45	-----	1293
T17	-----	1293
	-T-	
	Val	
OR.1905	-----	1290
OR.6106	-----	1290
OR.7632	-----	1290
OR.7587	-----	1290
NM.4094	-----	1290
NM.9999	-----	1290
OR.4541	-----	1290
NM.T529	-----	1290
OR.3136	-----	1290
OR.3759	-----	1290
OR.3473	-----	1290
OR.7145	-----	1290
1194	-----	1317
84	-----	648
1268	-----	298

**HPV16 variants
L1**

HPV16R	CCCCTTAAAAAATACACTTTTGGGAAGTAAATTTAAAGGAAAAGTTTCTGCAGACCTAGATCAGTTTCCT	7027
HPV16R	ProLeuLysLysTyrThrPheTrpGluValAsnLeuLysGluLysPheSerAlaAspLeuAspGlnPhePro	
114K	-----	1389
NM.T455	-----	1362
S23	-----	1365
OR.5110	-----	1362
OR.6170	-----	1362
S29	-----	1365
S83	-----	1365
OR.4724	-----	1362
OR.4997	-----	1362
OR.8329	-----	1362
S27	-----	1365
114B	-----	1389
OR.6311	-----	1362
NM.T446	-----	1362
OR.2087	-----	1362
OR.5428	-----	1362
OR.4716	-----	1362
S93	-----	1365
NM.T197	-----	1362
OR.9237	-----C-----	1362
	Gln	
OR.0198	-----	1362
OR.7574	-----	1362
S99	-----	1365
T45	-----	1365
T17	-----C-----	1365
	Ser	
OR.1905	-----t-----	1362
OR.6106	-----T-----t-----a-----	1362
	Asn	
OR.7632	-----t-----	1362
OR.7587	-----t-----	1362
NM.4094	-----t-----	1362
NM.9999	-----t-----	1362
OR.4541	-----t-----	1362
NM.T529	-----t-----	1362
OR.3136	-----t-----	1362
OR.3759	-----t-----	1362
OR.3473	-----t-----	1362
OR.7145	-----t-----	1362
1194	-----t-----	1389
84	-----C-----t-----a-----	700
	Thr	
1268	-----t-----	349

**HPV16 variants
L1**

HPV16R	TTAGGACGCAAATTTTACTACAAGCAGGATTGAAGGCCAAACCAAATTTACATTAGGAAAACGAAAAGCT	7099
HPV16R	LeuGlyArgLysPheLeuLeuGlnAlaGlyLeuLysAlaLysProLysPheThrLeuGlyLysArgLysAla	
114K	-----	1461
NM.T455	-----	1434
S23	-----a-----	1437
OR.5110	-----	1434
OR.6170	-----	1434
S29	-----	1437
S83	-----	1437
OR.4724	-----	1434
OR.4997	-----	1434
OR.8329	-----	1434
S27	-----	1437
114B	-----	1461
OR.6311	-----	1434
NM.T446	-----	1434
OR.2087	-----a-----	1434
OR.5428	-----a-----	1434
OR.4716	-----a-----	1434
S93	-----	1437
NM.T197	-----	1434
OR.9237	-----	1434
OR.0198	-----c-----	1434
OR.7574	-----a-----	1434
S99	-----	1437
T45	-----	1437
T17	-----	1437
OR.1905	-----T-----	1434
	Phe	
OR.6106	-----T-----g-----	1434
OR.7632	-----T-----	1434
OR.7587	-----T-----	1434
NM.4094	-----T-----	1434
NM.9999	-----T-----	1434
OR.4541	-----T-----	1434
NM.T529	-----T-----	1434
OR.3136	-----T-----	1434
OR.3759	-----T-----	1434
OR.3473	-----T-----	1434
OR.7145	-----T-----	1434
1194	-----g-----T-----	1461

**HPV16 variants
L1, LCR**

	LCR ->	
	nuclear localization signal (NLS) ->	<- L1 end
	- putative inhibitory element	
HPV16R	ACACCCACCACCTCATCTACCTCTACAACGCTAAACGCAAAAAACGTAAGCTGTAAGTATTGTATGTATGT	7171
HPV16R	ThrProThrThrSerSerThrSerThrThrAlaLysArgLysLysArgLysLeu\$\$\$	
114K	-----	1518
NM.T455	-----	1484
S23	-----	1468
OR.5110	-----	1484
OR.6170	-----	1484
S29	-----	1468
S83	-----	1468
OR.4724	-----	1484
OR.4997	-----	1484
OR.8329	-----	1484
S27	-----	1468
114B	-----	1518
OR.6311	-----	1484
NM.T446	-----	1484
OR.2087	-----	1484
OR.5428	-----	1484
OR.4716	-----	1484
S93	-----	1468
NM.T197	-----	1484
OR.9237	-----	1484
OR.0198	-----	1484
OR.7574	-----	1484
S99	-----	1468
T45	-----	1468
T17	-----	1468
OR.1905	-----	1484
OR.6106	-----	1484
OR.7632	-----	1484
OR.7587	-----	1484
NM.4094	-----	1484
NM.9999	-----	1484
OR.4541	-----	1484
NM.T529	-----	1484
OR.3136	-----	1484
OR.3759	-----	1484
OR.3473	-----	1484
OR.7145	-----	1484
1194	-----	1518
BAVINC0	-----	15
BAVINC3	-----	15
	putative inhibitory element	
	-	
HPV16R	TGAATTAGTGTGTTTGTGGTGTATATGTTTGTATGTGCTTGTATGTGCTTGTAAATATTAAGTTGTATGTG	7243
BT6	-----	70
BT11	-----	70
DT24	-----T-----	70
DC141	-----T-----	70
DC269	-----T-----	70
DC207	-----T-----	70
BT7	-----T-----C-----	70
BT15	-----T-----C-----	70
BAVINC0	-----T-----	87
BT20	-----T-----G-----	70
BT10	-----T-----G-----	70
BT12	-----T-----G-----	70
BT23	-----T-----	70
BT22	-----N-----NN-----	70
BAVINC3	-----T-----C-----	87

**HPV16 variants
LCR**

HPV16R	TGTTTGTATGTATGGTATAATAAACACGCTGTGTATGTGTTTTTAAATGCTTGTGTAACCTATTGTGTCATGCA	7315
BT6	-----	142
BT11	-----	142
DT24	-----	142
DC141	-----	142
DC269	-----	142
DC207	-----	142
BT7	-----	142
BT15	-----	142
BAVINC0	-----	159
BT20	-----	142
BT10	-----	142
BT12	-----	142
BT23	-----	142
BT22	-----	142
BAVINC3	-----G-----	159

poly-A signal -> <-

HPV16R	ACATAAATAAACTTATGTTTCAACACCTACTAATGTGTGTGGTTATTTCATTGTATATAAACTATATTG	7387
BT6	-----	214
BT11	-----	214
DT24	-----	214
DC141	-----	214
DC269	-----	214
DC207	-----C-----	214
BT7	-----	214
BT15	-----	214
BAVINC0	-----	231
BT20	-----	214
BT10	-----	214
BT12	-----	214
BT23	-----	214
BT22	-----	214
BB1	-----	37
BAVINC3	-----T-----	231

E2 binding ->

HPV16R	CTACATCCTGTTTTTGTATATATACTATATTTTGTAGCGCCAGCGCCATTTGTAGCTTCAACCGAAT	7459
BT6	-----	286
HDS81B.10/04/89	-----	13
HDS81B.11/07/90	-----	13
HDS81B.06/19/91	-----	13
HDS81B.02/24/92	-----	13
HDS69.10/16/89	-----	13
BT11	-----	286
DT24	-----	286
HDS85.06/12/90	-----	13
DC141	-----	286
DC269	-----	286
DC207	-----	286
BT7	-----	286
BT15	-----	286
BAVINC0	-----C-----	302
BT20	-----	286
BT10	-----	286
BT12	-----	286
BT23	-----	286
BT22	-----	286
BB1	-----	109
HDS109.07/25/90	-----	13
BAVINC3	-----TT-----	302

**HPV16 variants
LCR**

	<- E2 binding	
HPV16R	TCGG.TTGCATGCTTTTGGCACAAAATGTGTTTTTTTAAATAGTTCTATGTCAGCAACTATGGTTTAAACT	7530
OR.6170	-----	51
BB8A	-----	51
BT6	-----	357
HDS81B.10/04/89	-----	84
HDS81B.11/07/90	-----	84
HDS81B.06/19/91	-----	84
HDS81B.02/24/92	-----	84
HDS69.10/16/89	-----	84
BT11	-----	357
OR.5110	-----	51
NM.T455	-----	51
DT24	-----	357
HDS85.06/12/90	-----A-----	84
CASKI	-----A-----	51
OR.4724	-----A-----	51
OR.4997	-----A-----	51
OR.6311	-----A-----	51
OR.8329	-----A-----	51
NM.T197	-----A-----	51
OR.9237	-----A-----	51
NM.T446	-----A-----	51
OR.0198	-----A-----	51
SIHA	-----A-----	51
DC141	-----A-----	357
DC269	-----A-----	357
DC207	-----A-----	357
BT7	-----A-----	357
BT15	-----A-----	357
SB14	-----C-----A-----	51
SEQH	-----A-----	51
OR.7574	-----A-----	51
SB1	-----A-----	51
SB7	-----A-----	51
OR.2087	-----A-----	51
OR.5428	-----A-----	51
OR.4716	-----A-----	51
SB13	-----A-----	51
BAVINC0	---T-----A---C-----	374
SEQA	-----C-----A-----	51
SEQK	-----A-----	51
SEQI	-----A-----	51
GB13	-----A-----	51
SEQG	-----A-----	51
GB10	-----A-----	51
GB21A	-----A-----	51
BB24	-----A-----	51
SS1A	TA-----	51
SEQJ	-----A-----	51
BT20	-----A-----	357
BT10	-----A-----	357
BT12	-----A-----	357
SB5AA	-----A-----	51
BT23	-----A-----	357
BB3	-----A-----	51
BT22	-----A-----	357
SEQF	-----A-----	51
SEQD	-----A-----	51
TS6A	-----A-----	51
TB13	-----A-----	51
TS6B	-----A-----	51
OR.1905	-----A-----	51
TB4	-----A-----	51
OR.7587	-----A-----	51
TB8	-----A-----	51
OR.6106	-----A-----	51
OR.7632	-----A-----	51
TB16	-----A-----	51
TB15	-----A-----	51
OR.3136	-----C---A-----	51

**HPV16 variants
LCR**

SB21		-----C--A-----A-----	51
BB11		-----C--A-----A-----	51
OR.1783		-----C--A-----G-----A-----	51
SEQE		-----C--A-----A-----	51
OR.4541		-----C--A-----A-----	51
BB1		-----C--A-----A-----	180
HDS109.07/25/90		-----C--A-----A-----	84
NM.T529		-----C--A-----A-----	51
NM.9999		-----C--A-----A-----	51
OR.4072		-----C--A-----A-----	51
NM.4094		-----C--A-----A-----	51
SB16		-----C--A-----A-----	51
BB19		-----C--A-----G-----A-----	51
BB14		-----C--A-----G-----A-----	51
SEQC		-----C--A-----G-----A-----	51
BAVINC3	---T-----	-----C--A-----A-----	374
TS5		-----C--A-----A-----	51
TS5C		-----C--A-----A-----	51
TS5A		-----C--A-----A-----	51
TS5B		-----C--A-----A-----	51
TS3A		-----C--A-----C-----A-----	51
SEQL		-----C--A-----A-----	51
TS3C		-----C--A-----A-----	51
TS3B		-----C--A-----A-----	51
TS3		-----C--A-----A-----	51
OR.3473		-----C--A-----A-----	51
OR.3759		-----C--A-----A-----	51
OR.7145		-----C--A-----A-----	51
SEQN		-----C--A-----A-----	51
SB21A		-----C--A-----A-----	51
SEQM		-----C--A-----A-----	51

**HPV16 variants
LCR**

HPV16R	TGTACGTTTCCTGCTTGCCATGCGTGCCAAATCCCTGTTTTCTGACCTGCACTGCTTGCCAACCATTCAT	7602
OR. 6170	-----	123
BB8A	-----	60
BT6	-----	429
HDS81B.10/04/89	-----	156
HDS81B.11/07/90	-----	156
HDS81B.06/19/91	-----	156
HDS81B.02/24/92	-----	156
HDS69.10/16/89	-----	156
BT11	-----	429
OR. 5110	-----	123
NM. T455	-----	123
DT24	-----	429
HDS85.06/12/90	-----	156
CASKI	-----	123
OR. 4724	-----	123
OR. 4997	-----	123
OR. 6311	-----	123
OR. 8329	-----	123
NM. T197	-----	123
OR. 9237	-----	123
NM. T446	-----	123
OR. 0198	-----	123
SIHA	-----	123
DC141	-----	429
DC269	-----	429
DC207	-----	429
BT7	-----	429
BT15	-----	429
SB14	-----	123
SEQH	-----	123
OR. 7574	-----	123
SB1	-----	123
SB7	-----	123
OR. 2087	-----	123
OR. 5428	-----	123
OR. 4716	-----	123
SB13	-----	123
BAVINC0	-----	446
SEQA	-----	123
SEQK	-----	123
SEQI	-----	123
GB13	-----	123
SEQG	-----	123
GB10	-----A-----	123
GB21A	-----A-----	123
BB24	-----	123
SS1A	-----T-----	123
SEQJ	-----	123
BT20	-----	429
BT10	-----	429
BT12	-----	429
SB5AA	-----	123
BT23	-----	429
BB3	-----A-----	123
BT22	-----	429
SEQF	-----	123
SEQD	-----	123
TS6A	-----G-----	123
TB13	-----	123
TS6B	-----	123
OR. 1905	-----	123
TB4	-----	123
OR. 7587	-----	123
TB8	-----	123
OR. 6106	-----	123
OR. 7632	-----	123
TB16	-----	123
TB15	-----	123
OR. 3136	-----	123
SB21	-----	123

**HPV16 variants
LCR**

BB11	-----	123
OR. 1783	-----	123
SEQE	-----	123
OR. 4541	-----	123
BB1	-----	252
HDS109.07/25/90	-----	156
NM. T529	-----	123
NM. 9999	-----	123
OR. 4072	-----	123
NM. 4094	-----	123
SB16	-----	123
BB19	-----	123
BB14	-----	123
SEQC	-----	123
BAVINC3	-----	446
TS5	-----	123
TS5C	-----	123
TS5A	-----	123
TS5B	-----	123
TS3A	-----C-----	123
SEQL	-----	123
TS3C	-----T-----	123
TS3B	-----	123
TS3	-----A-----	123
OR. 3473	-----	123
OR. 3759	-----	123
OR. 7145	-----	123
SEQN	-----	123
SB21A	-----	123
SEQM	-----	123

**HPV16 variants
LCR**

	signal -> <-	
HPV16R	TGTTTTTTTACT.GCACTATGTG.CAACTACTGAATCACTATGTACATTGTGTCATATAAAATAAATCACT	7672
OR.6170	-----	193
BB8A	60
BT6	-----	499
HDS81B.10/04/89	-----	226
HDS81B.11/07/90	-----	226
HDS81B.06/19/91	-----	226
HDS81B.02/24/92	-----	226
HDS69.10/16/89	-----	226
BT11	-----	499
OR.5110	-----	193
NM.T455	-----	193
DT24	-----	499
HDS85.06/12/90	-----	226
CASKI	-----	193
OR.4724	-----	193
OR.4997	-----	193
OR.6311	-----	193
OR.8329	-----	193
NM.T197	-----	193
OR.9237	-----	193
NM.T446	-----	193
OR.0198	-----	193
SIHA	-----	193
DC141	-----	499
DC269	-----	499
DC207	-----	499
BT7	-----	499
BT15	-----	499
SB14	-----	193
SEQH	-----	193
OR.7574	-----	193
SB1	-----	193
SB7	-----	193
OR.2087	-----	193
OR.5428	-----	193
OR.4716	-----	193
SB13	-----	193
BAVINC0	-----	516
SEQA	-----	193
SEQK	-----	193
SEQI	-----	193
GB13	-----	193
SEQG	-----	193
GB10	-----	193
GB21A	-----A-----	193
BB24	-----	193
SS1A	-----G-----	193
SEQJ	-----	193
BT20	-----	499
BT10	-----	499
BT12	-----	499
SB5AA	-----G-----	193
BT23	-----	499
BB3	-----	193
BT22	-----	499
SEQF	-----	193
SEQD	-----	193
TS6A	-----	193
TB13	-----	193
TS6B	-----G-----	193
OR.1905	-----	193
TB4	-----	193
OR.7587	-----	193
TB8	-----	193
OR.6106	-----	193
OR.7632	-----	193
TB16	-----T-----	193
TB15	-----T-----	193
OR.3136	-----T-----	193

**HPV16 variants
LCR**

SB21	-----G-----G-----T---	195
BB11	-----T---	193
OR.1783	-----T---	193
SEQE	-----T---	193
OR.4541	-----T---	193
BB1	-----T---	322
HDS109.07/25/90	-----T---	226
NM.T529	-----T---	193
NM.9999	-----T---	193
OR.4072	-----T---	193
NM.4094	-----T---	193
SB16	-----T---	193
BB19	-----T---	193
BB14	-----T---	193
SEQC	-----T---	193
BAVINC3	-----G-----T---	516
TS5	-----G-----T---	193
TS5C	-----G-T-----T---	193
TS5A	-----G-----T---	193
TS5B	-----C-----G-----T---	193
TS3A	-----T---	193
SEQL	-----T---	193
TS3C	-----T---	193
TS3B	-----T---	193
TS3	-----T---	193
OR.3473	-----T---	193
OR.3759	-----T---	193
OR.7145	-----T---	193
SEQN	-----T---	193
SB21A	-----T---	193
SEQM	-----T---	193

**HPV16 variants
LCR**

HPV16R	ATGCGCCAACGCCTTACATACCGCTGTTAGGCACATATTTTTGGCTTGTTTTAACTAACCTAATTGCATATTT	7745
OR. 6170	-----	266
BB8A	95
BT6	-----	572
HDS81B.10/04/89	-----	299
HDS81B.11/07/90	-----	299
HDS81B.06/19/91	-----	299
HDS81B.02/24/92	-----	299
HDS69.10/16/89	-----	299
BT11	-----	572
OR. 5110	-----	266
NM. T455	-----	266
DT24	-----	572
HDS85.06/12/90	-----	299
CASKI	-----	266
OR. 4724	-----	266
OR. 4997	-----	266
OR. 6311	-----	266
OR. 8329	-----	266
NM. T197	-----	266
OR. 9237	-----	266
NM. T446	-----	266
OR. 0198	-----	266
SIHA	-----	266
DC141	-----	572
DC269	-----	572
DC207	-----	572
BT7	-----	572
BT15	-----	572
SB14	-----	266
SEQH	-----C-----	266
OR. 7574	-----C-----	266
SB1	-----C-----	266
SB7	-----C-----	266
OR. 2087	-----C-----	266
OR. 5428	-----C-----	266
OR. 4716	-----C-----	266
SB13	-----	266
BAVINC0	-----	588
SEQA	-----	266
SEQK	-----	266
SEQI	-----	266
GB13	-----G-----	266
SEQG	-----	266
GB10	-----	266
GB21A	-----	266
BB24	-----	266
SS1A	-----	266
SEQJ	-----	266
BT20	-----	572
BT10	-----	572
BT12	-----	572
SB5AA	-----	266
BT23	-----	572
BB3	-----	266
BT22	-----	572
SEQF	-----G-----	266
SEQD	-----A-----	266
TS6A	-----A-----	266
TB13	-----A-----	266
TS6B	-----A-----	266
OR. 1905	-----A-----	266
TB4	-----A-----	266
OR. 7587	-----A-----	266
TB8	-----A-----	266
OR. 6106	-----A-----	266
OR. 7632	-----A-----	266
TB16	-----A-----	266
TB15	-----A-----	266
OR. 3136	-----A-----C-----	266
SB21	-----	268

**HPV16 variants
LCR**

BB11	A	T	G	266
OR. 1783	A	C		266
SEQE	A	C		266
OR. 4541	A	C	G	266
BB1	A	C	G	395
HDS109.07/25/90	A	C	G	299
NM. T529	A	C	G	266
NM. 9999	A	C	G	266
OR. 4072	A	C	G	266
NM. 4094	A	C	G	266
SB16	A	C	G	266
BB19	A	C	G	266
BB14	A	C		266
SEQC	A	T		266
OR. 8392	A	T		57
BAVINC3	A	C	G	589
TS5	A			266
TS5C	A			266
TS5A	A			266
TS5B	A			266
TS3A	A			266
SEQL	A			266
TS3C	A			266
TS3B	A			266
TS3	A			266
OR. 3473	A			266
OR. 3759	A			266
OR. 7145				266
SEQN				266
SB21A				266
SEQM				266

**HPV16 variants
LCR**

HPV16R	GGCATAAGGTTTAAACTTCTAAGGCCAACTAAATGTCACCCTAGTTCATACATGAACTGTGTAAAGGTTAGTC	7818
OR. 6170	-----	339
BB8A	-----	168
BT6	-----	645
HDS117A.04/09/92	-----	69
HDS117A.08/12/92	-----	69
HDS84C.03/26/90	-----	69
HDS84C.07/23/90	-----	69
HDS106C.05/08/90	-----	69
HDS138.05/01/91	-----	69
HDS81B.10/04/89	-----	372
HDS81B.11/07/90	-----	372
HDS81B.06/19/91	-----	372
HDS81B.02/24/92	-----	372
HDS69.10/16/89	-----	372
BT11	-----	645
OR. 5110	-----	339
NM. T455	-----	339
HDS84D.07/23/90	-----	69
DT24	-----	645
HDS85.06/12/90	-----	372
CASKI	-----	339
OR. 4724	-----	339
OR. 4997	-----	339
OR. 6311	-----	339
OR. 8329	-----	339
NM. T197	-----	339
OR. 9237	-----	339
NM. T446	-----	339
OR. 0198	-----	339
SIHA	-----	301
DC141	-----	645
DC269	-----	645
DC207	-----	645
BT7	-----	645
BT15	-----	645
SB14	-----A-----	339
SEQH	-----C-----C-----	339
OR. 7574	-----C-----	339
SB1	-----C-----	339
SB7	-----	339
OR. 2087	-----	339
OR. 5428	-----	339
OR. 4716	-----	339
SB13	-----	339
HDS106A.02/13/90	-----	69
BAVINC0	-----	661
SEQA	-----	339
SEQK	-----T-----	339
SEQI	-----T-----	339
GB13	-----	339
SEQG	-----G-----	339
GB10	-----	339
GB21A	-----G-----	339
BB24	-----C-----G-----	339
SS1A	-----	339
HDS84B.03/26/90	-----T-----	69
SEQJ	-----T-----	339
BT20	-----	645
BT10	-----	645
BT12	-----	645
SB5AA	-----	339
HDS106B.02/13/90	-----	69
BT23	-----	645
BB3	-----	339
BT22	-----	645
SEQF	-----	339
SEQD	-----T-----	339
TS6A	-----T-----T-----	339
TB13	-----T-----T-----	339
TS6B	-----T-----T-----	339

**HPV16 variants
LCR**

OR.1905	T	T	339
TB4	T	T	339
OR.7587	T	T	339
TB8	T	T	339
OR.6106	T	T	339
OR.7632	T	T	339
TB16	T	T	339
TB15	T	T	327
OR.3136	T	T	339
SB21	T	T	341
BB11	T	T	339
OR.1783	T	T	339
SEQE	T	T	339
OR.4541	C	T	339
BB1	T	T	468
HDS109.07/25/90	T	T	372
NM.T529	T	T	339
NM.9999	T	T	339
OR.4072	T	T	339
NM.4094	T	T	339
SB16	T	T	339
BB19	T	T	339
BB14	T	T	339
SEQC	T	T	339
OR.8392	T	T	130
BAVINC3	T	T	662
TS5	T	T	339
TS5C	T	T	339
TS5A	T	T	339
TS5B	T	T	339
TS3A	T	T	339
SEQL	T	T	339
TS3C	T	T	339
TS3B	G	T	339
TS3	T	T	339
OR.3473	T	T	339
OR.3759	T	T	339
OR.7145	T	T	339
SEQN	T	T	339
SB21A	T	T	339
SEQM	T	T	339

**HPV16 variants
LCR**

HPV16R	ATACATTGTTTCATTTGTAAAACTGCACATGGGTGTGTGCAAACCGTTTTGGGTTACACATTTACAAGCAACTT	7891
OR. 6170	-----	364
BB8A	-----	193
BT6	-----	680
HDS117A.04/09/92	-----	142
HDS117A.08/12/92	-----	142
HDS84C.03/26/90	-----	142
HDS84C.07/23/90	-----	142
HDS106C.05/08/90	-----	142
HDS138.05/01/91	-----	142
HDS81B.10/04/89	-----	386
HDS81B.11/07/90	-----	386
HDS81B.06/19/91	-----	386
HDS81B.02/24/92	-----	386
HDS69.10/16/89	-----	386
BT11	-----	680
OR. 5110	-----	364
NM. T455	-----	364
HDS84D.07/23/90	-----	142
DT24	-----	680
HDS85.06/12/90	-----	386
CASKI	-----	364
OR. 4724	-----	364
OR. 4997	-----	364
OR. 6311	-----	364
OR. 8329	-----	364
NM. T197	-----	364
OR. 9237	-----	364
NM. T446	-----	364
OR. 0198	-----	364
SIHA	-----	326
DC141	-----	680
DC269	-----	680
DC207	-----	680
BT7	-----	680
BT15	-----	680
SB14	-----A-	364
SEQH	-----A-	364
OR. 7574	-----A-	364
SB1	-----A-	364
SB7	-----A-	364
OR. 2087	-----A-	364
OR. 5428	-----A-	364
OR. 4716	-----A-	364
SB13	-----A-	364
HDS106A.02/13/90	-----A-	142
BAVINC0	-----	734
SEQA	-----	364
SEQK	-----	364
SEQI	-----	364
GB13	-----	364
SEQG	-----	364
GB10	-----	364
GB21A	-----	364
BB24	-----	364
SS1A	-----	364
HDS84B.03/26/90	-----A-----	142
SEQJ	-----	364
BT20	-----	680
BT10	-----	680
BT12	-----	680
SB5AA	-----	364
HDS106B.02/13/90	-----A-----	142
BT23	-----	680
BB3	-----	364
BT22	-----	680
SEQF	-----	364
SEQD	-----	364
TS6A	-----T-----	364
TB13	-----T-----	364
TS6B	-----T-----	364

HPV16 variants
LCR

OR.1905	-----T-----	364
TB4	-----T-----	364
OR.7587	-----T-----	364
TB8	-----T-----	364
OR.6106	-----T-----	364
OR.7632	-----T-----	364
TB16	-----T-----	364
TB15	-----T-----	352
OR.3136	-----A-----T-----	364
SB21	-----	366
BB11	-----	364
OR.1783	-----	364
SEQE	-----	364
OR.4541	-----	364
BB1	-----	493
HDS109.07/25/90	-----	386
NM.T529	-----	364
NM.9999	-----	364
OR.4072	-----	364
NM.4094	-----	364
SB16	-----	364
BB19	-----	364
BB14	-----	364
SEQC	-----	364
OR.8392	-----	155
BAVINC3	-----G-----	735
TS5	-----A-----T--T-----	364
TS5C	-----A-----T--T-----	364
TS5A	-----A-----T--T-----	364
TS5B	-----A-----T--T-----	364
TS3A	-----A-----T--T-G----	364
SEQL	-----A-----T--G-----	364
TS3C	-----A-----T--T-G----	364
TS3B	-----A-----T--T-G----	364
TS3	-----A-----T--T-G----	364
OR.3473	-----A-----T--C-G----	364
OR.3759	-----A-----T--C-G----	364
OR.7145	-----A-----T--C-G----	364
SEQN	-----A-----T--T-G----	364
SB21A	-----A-----T--T-G----	364
SEQM	-----A-----T--T-G----	364

	signal ->	<-	
HPV16R	ATATAATAATACTAA		7906
HDS117A.04/09/92	-----		157
HDS117A.08/12/92	-----		157
HDS84C.03/26/90	-----		157
HDS84C.07/23/90	-----		157
HDS106C.05/08/90	-----		157
HDS138.05/01/91	-----		157
HDS84D.07/23/90	-----		157
HDS106A.02/13/90	-----		157
BAVINC0	-----		749
HDS84B.03/26/90	-----		157
HDS106B.02/13/90	-----		157
BAVINC3	-----		750

HPV-16 Sources of Variants

Sources for sequences in alignment of HPV16 variants

VARIANT	SOURCE	VARIANT	SOURCE
114B	[11]	F94_2	[5]
114K	[11]	F94_27	[5]
1194	[9, 8]	F94_42	[5]
1268	[9]	F94_44	[5]
649	[9]	F94_73	[5]
77	[9]	F94_76	[5]
84	[9]	F94_80	[5]
A00446	[12]	F94_85	[5]
ALABAMA-B23	[10]	F94_89	[5]
ALABAMA-B24	[10]	F94_113	[5]
ALASKA-C32	[10]	F94_135	[5]
ALASKA-C51	[10]	F94_143	[5]
B20	[4]	F94_161	[5]
B22	[4]	F94_179	[5]
B23	[4]	GB1=WV_2965	[4]
B25	[4]	GB3=WV_3096	[4]
B29	[4]	GB4=WV_3097	[4]
B30	[4]	GB5=WV_3270	[4]
B33	[4]	GB6=WV_3471	[4]
B61	[4]	GB10	[3]
BAVINC0	[2]	GB10=WV_4042	[4]
BAVINC3	[2]	GB11=WV_4043	[4]
BB1	[7, 3]	GB12=WV_4044	[4]
BB3	[7, 3]	GB13	[3]
BB8A	[7, 3]	GB13=WV_75	[4]
BB11	[7, 3]	GB14=WV_1024	[4]
BB14	[7, 3]	GB21A	[3]
BB19	[7, 3]	GEORGIA-B9	[10]
BB24	[7, 3]	H84	[8]
BT6	[14]	HDS69.10/16/89	[15]
BT7	[14]	HDS81A.02/24/92	[15]
BT8	[14]	HDS81A.06/19/91	[15]
BT9	[14]	HDS81A.10/04/89	[15]
BT10	[14]	HDS81A.11/07/90	[15]
BT11	[14]	HDS81B.02/24/92	[15]
BT12	[14]	HDS81B.06/19/91	[15]
BT15	[14]	HDS81B.10/04/89	[15]
BT20	[14]	HDS81B.11/07/90	[15]
BT22	[14]	HDS84A.03/26/90	[15]
BT23	[14]	HDS84A.07/23/90	[15]
CASKI	[3]	HDS84B.03/26/90	[15]
DC141	[14]	HDS84C.03/26/90	[15]
DC207	[14]	HDS84C.07/23/90	[15]
DC212	[14]	HDS84D.07/23/90	[15]
DC255	[14]	HDS85.06/12/90	[15]
DC269	[14]	HDS106A.02/13/90	[15]
DT4	[14]	HDS106A.05/08/90	[15]
DT24	[14]	HDS106B.02/13/90	[15]
DT42	[14]	HDS106C.05/08/90	[15]

HPV-16 Sources of Variants

VARIANT	SOURCE	VARIANT	SOURCE
HDS109.07/25/90	[15]	OR.7875	[16]
HDS109.11/30/90	[15]	OR.7908	[16]
HDS117A.04/09/92	[15]	OR.8160	[16]
HDS117A.08/12/92	[15]	OR.8329	[16]
HDS117B.04/09/92	[15]	OR.8392	[16]
HDS138.05/01/91	[15]	OR.8863	[16]
HPK_IB	[4]	OR.8987	[16]
HPK_II	[4]	OR.9237	[16]
HPV16R	[1]	PANAMA-136	[10]
MICHIGAN-B8	[10]	PANAMA-148	[10]
MISSOURI-B11	[10]	PANAMA-156	[10]
NM.4094	[16]	PANAMA-200	[10]
NM.9999	[16]	PANAMA-206	[10]
NM.T197	[16]	PANAMA-349	[10]
NM.T446	[16]	PANAMA-A12	[10]
NM.T455	[16]	PANAMA-A13	[10]
NM.T529	[16]	PANAMA-B20	[10]
O162	[8]	PANAMA-B4	[10]
O191	[8]	PANAMA-C10	[10]
O204	[8]	PANAMA-C20	[10]
O356	[8]	PANAMA-D6	[10]
O424	[8]	PANAMA-F15	[10]
O425	[8]	PANAMA-F30	[10]
O462	[8]	PANAMA-F38	[10]
O489	[8]	PANAMA-F43	[10]
O512	[8]	S23	[13]
O559	[8]	S27	[13]
O561	[8]	S29	[13]
OR.0198	[16]	S83	[13]
OR.1783	[16]	S93	[13]
OR.1905	[16]	S99	[13]
OR.2087	[16]	S108	[13]
OR.3136	[16]	SB1	[7, 3]
OR.3473	[16]	SB2	[7, 3]
OR.3759	[16]	SB5	[7, 3]
OR.4072	[16]	SB5AA	[3]
OR.4451	[16]	SB7	[3]
OR.4541	[16]	SB10	[7, 3]
OR.4716	[16]	SB13	[7, 3]
OR.4724	[16]	SB14	[7, 3]
OR.4997	[16]	SB16	[7, 3]
OR.5110	[16]	SB17	[7, 3]
OR.5428	[16]	SB21	[7, 3]
OR.5691	[16]	SB21A	[3]
OR.6106	[16]	SA-9	[6]
OR.6170	[16]	AM-6	[6]
OR.6311	[16]	P-1	[6]
OR.7145	[16]	SL-6a	[6]
OR.7574	[16]	AN-12	[6]
OR.7587	[16]	IND-7	[6]
OR.7632	[16]	IND-4	[6]
OR.7754	[16]	J-5	[6]

HPV-16 Sources of Variants

VARIANT	SOURCE	VARIANT	SOURCE
AP-4	[6]	TB8=A36	[4]
IND-5	[6]	TB9=A42	[4]
SH-2a	[6]	TB11=A46	[4]
SN-4	[6]	TB12=A50	[4]
AN-10	[6]	TB13	[3]
AN-10a	[6]	TB14=A54	[4]
SIHA	[3]	TB15	[3]
SS1A	[3]	TB15=A56	[4]
T3	[13]	TB16	[3]
T17	[13]	TB16=A61	[4]
T45	[13]	TB17=A62	[4]
T49	[13]	TS3	[3]
TB1	[3]	TS3A	[3]
TB1=A6	[4]	TS3B	[3]
TB3=A16	[4]	TS3C	[3]
TB4	[3]	TS5	[3]
TB4=A21	[4]	TS5A	[3]
TB5=A24	[4]	TS5B	[3]
TB6=A27	[4]	TS5C	[3]
TB7=A32	[4]	TS6A	[3]
TB8	[3]	TS6B	[3]

- [1] This compendium.
- [2] P.J. Bavin, P.G. Walker, and V.C. Emery. Sequence microheterogeneity in the long control region of clinical isolates of human papillomavirus type 16. *Journal of Medical Virology*, 39(4):267–72, 1993. Sequences constructed by editing reference sequence (HPV16R) according to figures in article, with corrections from authors (V.C. Emery p.c.).
- [3] S.Y. Chan, H.U. Bernard, C.K. Ong, S.P. Chan, B. Hofmann, and H. Delius. Phylogenetic analysis of 48 papillomavirus types and 28 subtypes and variants: a showcase for the molecular evolution of DNA viruses. *Journal of Virology*, 66(10):5714–25, 1992. Sequences obtained from GenBank.
- [4] D. Eschle, M. Durst, J. terMeulen, J. Luande, H.C. Eberhardt, M. Pawlita, and L. Gissmann. Geographical dependence of sequence variation in the E7 gene of human papillomavirus type 16. *Journal of General Virology*, 73(7):1829–32, 1992. Sequences constructed by editing reference sequence (HPV16R) according to figures in article.
- [5] Y. Fujinaga, K. Okazawa, A. Nishikawa, Y. Yamakawa, M. Fukushima, I. Kato, and K. Fujinaga. Sequence variation of human papillomavirus type 16 E7 in preinvasive and invasive cervical neoplasias. *Virus Genes*, 9(1):85–92, 1994. Sequences constructed by editing reference sequence (HPV16R) according to figures in article.
- [6] L. Ho, S.Y. Chan, R.D. Burk, B.C. Das, K. Fujinaga, J.P. Icenogle, T. Kahn, N. Kiviat, W. Lancaster, P. Mavromara-Nazos, et al. The genetic drift of human papillomavirus type 16 is a means of reconstructing prehistoric viral spread and the movement of ancient human populations. *Journal of Virology*, 67(11):6413–23, 1993. Sequences obtained from GenBank.
- [7] L. Ho, S.Y. Chan, V. Chow, T. Chong, S.K. Tay, L.L. Villa, and H.U. Bernard. Sequence variants of human papillomavirus type 16 in clinical samples permit verification and extension of epidemiological studies and construction of a phylogenetic tree. *Journal of Clinical Microbiology*, 29(9):1765–72, 1991.
- [8] J.P. Icenogle. Sequences constructed by editing reference sequence (HPV16R) according to figures in article, kindly provided prior to publication, 1995.
- [9] J.P. Icenogle, M. Laga, D. Miller, A.T. Manoka, R.A. Tucker, and W.C. Reeves. Genotypes and sequence variants of human papillomavirus DNAs from human immunodeficiency virus type 1-infected women with cervical intraepithelial neoplasia. *Journal of Infectious Diseases*, 166(6):1210–6, 1992. Sequences constructed by editing reference sequence (HPV16R) according to figures in article.
- [10] J.P. Icenogle, P. Sathya, D.L. Miller, R.A. Tucker, and W.E. Rawls. Nucleotide and amino acid sequence variation in the L1 and E7 open reading frames of human papillomavirus type 6 and type 16. *Virology*, 184(1):101–7, 1991. Sequences constructed by editing reference sequence (HPV16R) according to figures in article.
- [11] R. Kirnbauer, J. Taub, H. Greenstone, R. Roden, M. Durst, L. Gissmann, and D.R.; Schiller JT Lowy. Efficient self-assembly of human papillomavirus type 16 L1 and L1-L2 into virus-like particles. *Journal of Virology*, 67(12):6929–36, 1993. Sequences constructed by editing reference sequence (HPV16R) according to figures in article.
- [12] G. Meneguzzi. Pharmaceutical composition useful in the prevention or treatment of papillomavirus-induced tumours. Patent: WO 9010459-A 2120-SEP-1990; Transgene S.A. Sequence obtained from GenBank.
- [13] P. Pushko, T. Sasagawa, J. Cuzick, and L. Crawford. Sequence variation in the capsid protein genes of human papillomavirus type 16. *Journal of General Virology*, 75(4):911–6, 1994. Sequences constructed by editing reference sequence (HPV16R) according to figures in article, with corrections to sequence numbering from authors (L. Crawford p.c.).
- [14] H.L. Smits, K.F. Traanberg, M.R. Krul, P.R. Prussia, C.L. Kuiken, M.F. Jebbink, J.A. Kleyn, R.H. van den Berg, B. Capone, A. de Bruyn, et al. Identification of a unique group of human papillomavirus type 16 sequence variants among clinical isolates from Barbados. *Journal of General Virology*, 75(9):2457–62, 1994. Sequences constructed by editing reference sequence (HPV16R) according to figures in article, with corrections to sequence numbering from authors (L. Crawford p.c.).
- [15] L.F. Xi, G.W. Demers, L.A. Koutsky, N.B. Kiviat, J. Kuypers, D.H. Watts, K.K. Holmes, and D.A. Galloway. Analysis of human papillomavirus type 16 variants indicates establishment of a persistent infection. *J. Infect. Dis.*, 172:747–755, 1995.
- [16] T. Yamada, C.M. Wheeler, A.L. Halpern, A.-C.M. Stewart, A. Hildesheim, B.B. Rush, and S.A. Jensen. Human papillomavirus type 16 variant lineages in United States populations characterized by nucleotide sequence analysis of the E6, L2 and L1 coding segments. *Journal of Virology*, In press. Sequences kindly provided prior to publication.